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DOCTOR OF PHILOSOPHY

Quality Assurance related to secondary education in the Kingdom of Bahrain

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Khaled Ahmed Almadani

2012

University of Dundee

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**Quality Assurance Related to Secondary Education  
in the Kingdom of Bahrain**

By

**Khaled Ahmed Almadani**

A Thesis Submitted for the Degree of Doctor of Philosophy (PhD)

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## **Abstract**

Quality assurance in schools and in higher education has been a growth industry for many years, with all kinds of agencies being funded. With apparently endless growth in education at all levels, with insistent demands on more resources, the political pressures in ensuring value for money have increased.

This study explores the perceptions of teachers, students and senior administrators of quality assurance in secondary schools (ages about 15-18 in Bahrain) in the Kingdom of Bahrain. Here, there is established system of quality assurance but there is a general feeling of unrest that all is not well in the way quality assurance has developed.

The overall aim is to enhance quality assurance in Bahrain, based on sound pedagogical evidence. This study provides an overview of quality assurance in secondary schools in Bahrain with the teachers, students and senior staff. This aims to look at the way secondary education is offered in Bahrain, to explore possible ways to enhance educational provision and, where possible, to look for any evidence that Quality Assurance has improved quality.

This study has aimed to gain an overall view of what is happening in secondary education in Bahrain and to identify areas which need further attention. The approach has been very much focussed on the learner.

The first experiment seeks to find out how some key stakeholders see present provision in secondary education (ages 15-18) in Bahrain. The aim is to gain an overview of perceptions and to identify areas where there are issues to be addressed. This study describes two surveys which were conducted with 793 students and 793 teachers related particularly to their perceptions. 23 senior staff in the Ministry of Education and Quality Assurance Authority in Kingdom of Bahrain were also interviewed individually in order to gain more information about their perceptions of quality assurance in the Kingdom.

It is very evident that the pictures painted by the students, their teachers and those in educational leadership are very different. In particular, the educational leadership stand out in offering very different perspectives. It is, therefore, obvious that there is little shared agenda other than an overall wish for educational quality, but what is meant by this is not even clear. There is a clear message that the educational leadership needs to consult and listen more to teachers and students if any shared agenda is to be reached.

Perhaps, the teachers have a better insight into reality while the students must take a central role in that the schools are there for their benefit.

Several issues stood out from the surveys but two were followed up in this study. The first is that there is considerable disquiet about national assessment (which controls in-school assessment practices). The second is that the students want to move away from the teacher-centred lecture approach to have opportunities to work in groups and discuss.

In the light findings of these findings, the examination marks for a sample of 7022 students in their final year of school was gained. The data were considered descriptively as well as being analysed using Factor Analysis. It was readily apparent that there are major issues to be addressed and that was perhaps what the students were drawing attention to in the surveys. Firstly, the examination papers are far too easy, with little opportunity for students to show their abilities. Secondly, the factor analyses showed that all the subject examinations merely tested one skill, a scrutiny of papers showing that was recall.

In order to explore the potential role of group working in schools, a sample of 817 students in three age-groups in secondary school undertook a short series of short group-work problem solving exercises in one subject discipline. Student performance as well as their reactions were measured. It was found that there were some advantages in understanding arising from the use of such units but the effects were not universally beneficial for all of the units used. Student reactions tended to be positive but not overwhelmingly so.

The main findings revealed that there is a major lack of consistency and shared understanding between those who take the decisions in education (and the documentation they generate) and the realities of what goes on in schools (as reflected by teachers and learners). There is a need to focus on the learners, their experiences, their achievements and their needs as they move out into higher education or the workplace. There is a need to widen the range of skills being assessed and to develop resources to enable these skills to grow. Above all, the role of quality assurance in Bahrain has to be one that empowers the teachers rather than inspects them and criticises, often on matters over which teachers have no control.

### **Acknowledgment**

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## Chapter 1

### Introduction

#### 1.1 Education in the Kingdom of Bahrain

Education is a relatively recent development in the Kingdom of Bahrain. Humood (1987) noted that education in Bahrain began in memorisation schools where the curriculum was mainly memorising the *Qur'an*, basics of reading and writing Arabic with some basic arithmetic calculations. Official schools were later founded on this religious education. Besides the memorisation schools, there were some national and international schools. MoE (2012) observed that the *Qur'an* was the basis of the only form of education in Bahrain at the beginning of the 20th century, involving traditional schools aimed at teaching children and youth the reading of the Holy Quran.

Over the years, many people of Bahrain had felt that this type of education did not fulfil modern education needs and aspirations. After the First World War, things changed and Bahrain became widely open to modern western renaissance. Political and social changes occurred in the country that caused the rise of social and cultural awareness among people. Humood (1987) stated the first school in Bahrain was founded by an American Mission in 1892 and it was the first girls' school in the Gulf. This was followed by opening about ten schools for boys between the years 1901 and 1902. The curriculum included teaching English, mathematics and Arabic grammar. Before 1919, a number of prominent citizens in Muharraq Island had discussed and agreed to establish a modern formal school. A number of the Royal people had endorsed this call and contributed to this project (MoE, 2012).

In 1919, the first official school for boys was founded (Al-Hidaayah Al-Khaleefiyyah School at Al-Muharraq), the result of efforts of some distinguished individuals in the country who formed an educational committee for school administration (Hummed,

1987). In 1926, the Education Committee opened the second public school for boys at Manama. In 1928, the first public school for girls was opened at Muharraq (MoE, 2012). Due to the financial and administrative difficulty faced by the Education Committee, the schools came under the direct control of the government in 1930.

The curriculum was a mix of religious and contemporary education taken from Arab countries. Most teachers were from Egypt, Syria and Lebanon. Afterwards, some teachers were brought from Basrah in Iraq (Humood 1987).

Humood (1987) described further developments. From the years 1928 to 1951, five primary schools were opened, two for girls and three for boys. In 1961, the intermediate stage was founded and the system for the three stages began: primary six years, intermediate two years and secondary three years. Higher education institutes then opened: The Teaching Institute for male teachers, 1966; and for female teachers, 1967; the Gulf College for Industry, 1968; the College of Medical Sciences and Centre for Training and Hotels, 1976; and the University College of Bahrain, 1978. Educational development was slow before and after the second world war. However, rapid educational changes began in 1950. Nonetheless, 1940 was the year often regarded as the start point for educational development since teaching hours were established as well as teacher qualifications.

Over the last century of its history, the Kingdom of Bahrain has made massive progress in education. Bahrain has given education its prime attention since its basic establishment in 1919 and today it places it at the core of its thinking and priorities to the extent that his eminence, the King, has given education the national priority. He endorsed the education law (2005) in the country that states that education is a right that the Kingdom fulfils to all citizens. The law also states that basic education is a right for

every child reaching six years of age, this education being free from first primary year until the end of secondary education (Gulf News newspaper, 2005).

All of this gave the Ministry of Education a high profile. It had to develop schools meeting the needs of society as well as taking into account the role of education in comprehensive and continuous development. In an attempt to overcome current problems that secondary education suffers from, especially congestion in some specialties and turning away from, the Ministry of Education strives today to change towards unified educational methods in secondary education. For this purpose, it formed a network of groups. They had the task of studying the practical components of education: curricula, evaluation, training, strategies and strength of trained implementation. This is also in the belief that development is a comprehensive process: all the parts of the system must work and develop together.

The direction of secondary education in Bahrain passed through a number of stages of change that can be summarized as follows (Development of Education in Bahrain, 2004).

- In 1940 Meeting the increasing needs for providing administrative and technical areas in sectors of administration, trade and industry.
- In 1980 Introducing the system of 'branching' in an attempt to reform general and technical secondary education. This allowed students to select courses in a number of new branches and specializations that were needed (*e.g.* health sciences, nursing, hotels, textiles and clothes, agriculture, printing). There was also development and expansions of the branches of humanities and sciences.
- In 1989 A review of all aspects of secondary education. The system underwent a complete evaluation in the academic year 1994-95. A number of changes were made arising from this evaluation, mostly organisational. Nonetheless, the whole system needs further renewal today.



## 1.2 The Education System in Bahrain Today

The education system in the Kingdom of Bahrain follows an educational ladder: nine years of basic education, including both primary and intermediate stages and three years for secondary education with its different courses (figure 1.1).

Grade	Entry Age	Stage			
12	17	Secondary Education	General	- Science Track - Literary Track - Commercial Track - Technical and Vocational Track	Religions Education  (Primary, Intermediate, Secondary)
11	16				
10	15				
9	14	Basic Education	3rd Cycle (Intermediate)		
8	13				
7	12				
6	11		2nd Cycle (Primary)		
5	10				
4	9				
3	8		1st Cycle (Primary)		
2	7				
1	6				

**Figure 1.1 The Education Ladder in the Kingdom of Bahrain**  
(Source: MoE 2012)

Basic education is divided into two stages: primary education and intermediate education. The primary stage lasts for six years and is formed into two levels. The first level includes the first three years of primary education and is led by a class teacher who teaches everything except English, Design and Technology and Physical Education. The second level includes the higher three years and each subject is taught by a specialised teacher for that subject.

Students have access to the intermediate stage if they pass the year six examination. This stage is regarded as the stage for bridging and a support for the primary stage and foundation step to secondary education. This stage applies the system of subject teachers where each academic subject is taught by a specialised and qualified teacher.

The Secondary Education stage is the focus of this study and is now discussed

### 1.3 Secondary Education in Bahrain

Secondary education is regarded as the time for preparation for higher education or the work market. Entrance into the first academic term of secondary education is conditional on achieving a certificate of completion of intermediate study or equivalent. There is provision of a wide choice of academic subjects, allowing the student to suit the study to agree with future aims. The study in secondary education finishes with the student sitting the Certificate for General Secondary Education in the branch of study undertaken (MoE 2012). Secondary education lasts for three years, divided into six semesters of three levels.

In the system, the student has a choice to pursue a science curriculum, a literary curriculum, a commercial curriculum, a technical curriculum, textile and clothing track. The last track is for girls only. Students are able to change tracks depending on the common courses among more than one specialization. The study plan of the secondary level (credit hours system) is based on the total credit hours required to complete secondary education: 156 credit hours for scientific, literary, commercial, textile track; and 210 credit hours for technical track.

The credit hours are divided into four groups of courses (Table 1.1).

	% of time	
Core courses	24-45	Information, skills, and attitudes that help the students to continue their study and self-learning.
Specialised courses	39-65	Key themes of specialisms to give basis of requisite knowledge and experience
Elective specialized courses	8-19	Enriching themes of specialisms to encourage student interests
Free elective courses	8	Enrichment of the curriculum, satisfying the student interests and talents

**Table 1.1 Secondary curriculum organization**

The daily timetable consists of six periods each of 50 minutes at all secondary schools.

#### **1.4 The Assessment System in Secondary Education in Bahrain.**

The assessment system in secondary education in Bahrain is divided into three evaluations. Each is now discussed in turn.

*The continuous, diagnostic and formative evaluation* carried out by the teacher of each course throughout the semester. It comprises 30% of the course's final grade, computed according to the oral and written classroom performance tests.

*The internal evaluation* is the evaluation made by the school by means of a mid-semester examination comprising 20% of the course's final grade. Specialized teachers in each subject matter are participating in this process, supervised by a senior teacher.

*The external evaluation* comprises 50% of the course's final grade. The Ministry of Education is carrying out this process in collaboration with the schools by means of unified examination supervised by round committees formed by the Ministry. These committees comprise curriculum specialists and senior teachers. They inspect schools regularly and organize cumulative and summative evaluation.

Student must attain an overall score of at least 50% in each subject area, on condition that the students attain 20% out of internal evaluations overall grade, and the same in the cumulative evaluation carried out by the Ministry at the end of each semester.

The student must attain an overall score of at least 50% of final cumulative average, and complete all the study requirements to obtain the Secondary School Certificate.

## 1.5 Aims for the future

The Ministry of Education (MoE 2012) has developed the Vision and the Mission of Education in Bahrain, presented here in translation.

*The Vision “seeks to develop a qualitative education system to reach a high degree of excellence and creativity. This vision emanates from the Islamic Religion lofty principles and values and the Kingdom of Bahrain's interaction with the human civilization and its Arab belonging to satisfy the requirements of continuous development that conforms with the international standards, as stated in the Kingdom's constitution”.*

*The Mission “provides educational opportunities for every citizen to develop his/her mental, physical and emotional potential and skills through drawing up development plans, their implementation and evaluation to achieve the requirements of quality to enhance the quality and effectiveness of education in line with the international standards as stated in the Education Law, Higher Education Law and Private Education Institutions Law in the Kingdom of Bahrain” .*

## 1.6 Quality assurance

This study focusses on quality assurance in secondary education in the Kingdom of Bahrain. The aim is to consider broad principles as well as practical applications and, thus, it is hoped that the findings will be of much wider value. Quality assurance has been a major element in business and industry for a long time. It has two main aims: ensuring that the products meet basic standards of quality so that consumers are satisfied; seeking ways by which quality can be enhanced.

Quality assurance in education became an important issue in the West in the 1980s, with the emphasis on ensuring value for money, and later has been applied widely throughout the world. The model derived from business and industry has been adopted by most countries. This has generated problems in that the measurement of the ‘product’ from education is problematic. This issue will be explored in some detail in this thesis.

### 1.7 Quality assurance procedures currently used

Quality assurance in Bahrain starts from the vision and mission stated by the Quality Assurance Authority of Education and Training (QAAET). In the vision, all stakeholders are, *‘To be partners in developing a world-class education system in Bahrain’* (p:7). In its mission, the QAAET (2011, p: 7) stated that,

*“As an independent entity, we assure the quality of education and training in Bahrain by:*

- Reviewing public and private schools, vocational training and higher education institutions, both for accountability and improvement purposes;*
- Developing and implementing a national examination system for schools;*
- Publishing reports of findings;*
- Advancing Bahrain’s reputation as a leader in quality assurance in education regionally and internationally”.*

Quality Assurance Authority of Education and Training (QAAET) procedures currently used in Bahrain revolve around three points: Schools Reviews; After School Reviews; Recommendations for Improvement. School inspection reports produced by the QAAET in Bahrain are forwarded to the quality assurance section in MoE. The latter is then supposed to follow up with training and advice. There are many potential weaknesses in this approach in that many of the key decisions about education are outwith the control of schools. In addition, the approach lacks a clear description of agreed criteria of excellence, against which quality can be assessed.

## 1.8 Aims of this study

Education in the Kingdom of Bahrain is a relatively recent development. The focus on teaching and learning is even more recent and, while schools possess quality assurance, there is a general feeling of unrest that all is not well in the way quality assurance has developed and is used and applied. This observed unrest among teachers generated the main reason for conducting this study: is the unrest justified?

Against this background, the overall aims of this study are:

- (a) To look at the way secondary education is offered in Bahrain.
- (b) To explore possible ways to enhance educational provision.
- (c) Where possible, to look for any evidence that Quality Assurance has improved quality.

These aims can be translated into research questions:

- (1) How is quality perceived by various stakeholders involved in secondary education in Bahrain?
- (2) What specific aspects of the secondary education provision require adjustment or improvement to enhance quality in secondary education in Bahrain?
- (3) Is there any evidence that current quality assurance procedures are making a contribution in enhancing quality in secondary education in Bahrain?

Sub-questions can be drawn from the first question:

- (1a) How is quality perceived by secondary school students when they look back over their educational experiences in secondary education in Bahrain?
- (1b) How is quality perceived by secondary school teachers working in secondary education in Bahrain?
- (1c) How is quality perceived by educational administrators who carry responsibilities in relation to secondary education in Bahrain?

Further sub-questions can be drawn for the second question:

- (2a) What specific aspects of the secondary education provision are seen by the students to need adjustment?

- (2b) What specific aspects of the secondary education provision are seen by the teachers to need addressed?
- (2c) What specific aspects of the secondary education provision are seen by the educational administrators to need addressed?

The project will analyse what may be possible in school quality assurance in order to identify some essential features which will facilitate secondary schools in Bahrain in becoming more effective and efficient. The overall purpose is to be able to offer to the Kingdom a clear picture of the present scene in quality assurance and to identify the kinds of developments which are needed in order to take this aspect of learning forward positively and effectively.

## **1.9 This Study**

This thesis consists of ten chapters including this one. Chapter two considers traditional views of quality assurance in relation to the purpose of the study. It also attempts to look at the idea of ‘*quality*’ and, in order to understand quality assurance fully, the *development* of quality assurance also includes a description of some of the quality assurance tools and techniques. Finally, it concludes with a brief description of the quality systems and improvement reform.

Chapter three reviews the literature and research generally in teacher education in schools, and particularly in the quality of teaching and learning, as well as in teacher evaluation. Teachers are important in looking at the enhancement of quality and the chapter will focus on what is known about the enhancement and support for such quality as well as ways of evaluating it.

The learners are arguably the key group in education provision. The teaching, the resources and the support as well as curriculum structures and assessment procedures will all make a large contribution. Chapter four moves the focus to the learners and

how to ensure they are getting the highest quality education possible. It also includes a consideration of learning strategies used by teachers and their value for learning.

Many countries have developed a variety of approaches to quality assurance in schools. In most cases, there is little documentation available. Chapter five presents how quality assurance in education has been measured in a selection of different countries including Bahrain. The countries were selected to reflect the practices in very different parts of the world, with very different educational culture.

An important part of the entire study is look at how aspects of quality are perceived by key stockholders. This means studying their perceptions of what is happening. Indeed, the perceptions of stakeholders are critical for quality assurance to operate successfully. Perceptions can be regarded as components of attitudes and the relationships between perceptions and attitudes will be explored.

Thus, chapter six focusses on a general review of attitude development. This starts by exploring what an attitude is and considering definitions for attitudes. The way attitudes form and develop as well as methods for measuring attitudes are outlined. Also the importance of attitudes and the place of attitudes in education are discussed. Finally, it seeks to offer an overview of the key developments in the field and to indicate how the approaches used in this study derive from the procedures of others.

Chapter seven's aim is to gain an overview of perceptions of three major groups in Bahrain: the students at secondary stages, their teachers, educational managers. This overview is gained by means of surveys and interviews and seeks to identify areas where there are issues to be addressed.

A number of aspects of secondary education provision in Bahrain were found from the questionnaires and interviews to face problems. Two of these areas are explored in detail in the final two chapters. Chapter eight looks critically at some aspects of the



national assessment system in Bahrain. Chapter nine explores how the students in Bahraini secondary schools react to learning by means of group work.

Finally, chapter ten gives a summary of the findings of the current research along with recommendations for the future.

## Chapter 2

### Traditional Views of Quality Assurance

#### 2.1 Introduction

Quality assurance has become a central concept and core policy of education in most countries (Brennan and Shah, 2000a). More than 60 countries have established their own national quality assurance systems for education over the last fifteen years (Khawas, 2001). The fact that quality assurance is a mechanism that governments have used to steer education has been recognized as an international phenomenon (Harman, 1996; Kemp, 1999).

Quality assurance has been taken up across many different types of organisations including business, commerce and more recently public services including education. Advocates of quality assurance argue for its stakeholder orientation. Among the claims made for quality assurance are that all members of quality assurance organizations strive to manage the improvement of the organization through the ongoing participation of all employees in problem solving and decision making efforts across different hierarchical boundaries. However, it is important we look in detail at quality assurance both conceptually and in its practical application.

As the starting point, in this chapter we explore various definitions of the concept of quality. Quality is a relative as opposed to an absolute concept. It is something towards which one aims to seek improvement rather than achievement. This chapter looks at the idea of '*quality*' and, in order to understand quality assurance fully, the *development* of quality assurance. This chapter also includes a description of some of the quality assurance tools and techniques. Finally, this chapter concludes with a brief description of the quality systems and improvement reform.

## 2.2 The Concept of Quality

Quality has emerged as, and remains, a dominant theme in management literature since the 1980s. Despite its popularity, the term has a variety of contradictory meanings. This is partly because the term implies different meanings to different people in different contexts. This confusion can also be due to the ambiguity of the term itself as it is a context dependent construct. Thus, Pfeffer and Coote (1991, p.31) state “*quality has a slippery meaning*”. In order to gain an understanding of the concept of ‘*quality*’, various definitions will now be discussed.

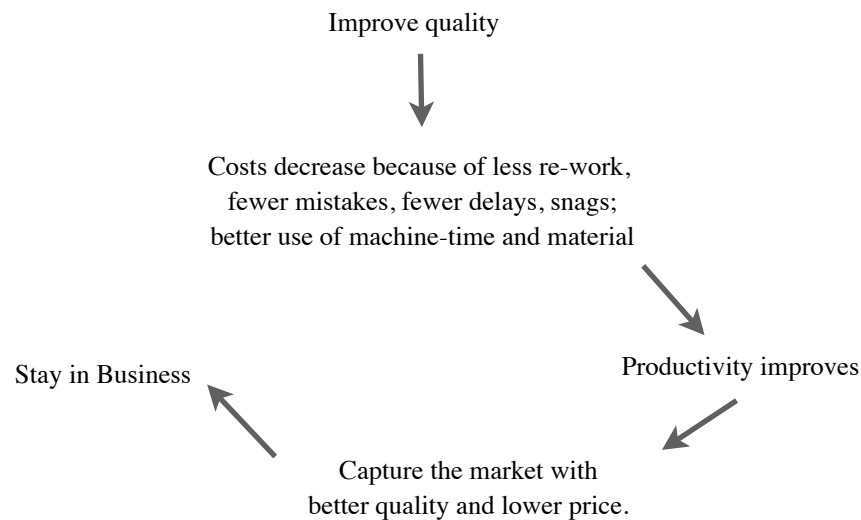
If we draw from various dictionary definitions of the word ‘*quality*’, the following aspects are highlighted, Oxford English Dictionary (1999, p.1170):

- ★ The standard of something as measured against other things of a similar kind.
- ★ A degree of excellence or worth.
- ★ The condition of being of such and such a sort as distinguished from others, nature or character relatively considered, as of goods; character; sort; rank.

Definitions that have been put forward by different dictionaries tend to focus on various different facets of the term. These facets typically go around the idea of the nature of the product or service, the excellence, the comparison and competition of the same kind of things. All of the previous definitions are merely general meanings of quality.

In reviewing the literature on management, it is revealed that there are also various definitions of quality. These definitions are related to a body of knowledge about product, service and customer and client satisfaction. Deming, Crosby and Juran are the key writers whose individual ideas continue to dominate the quality movement. According to Deming (1986, p.5) “*quality should be aimed at the needs of the consumer, present and future*”. In his definition of quality, he emphasises that the stakeholder is the most important group in measuring quality, and their needs and

expectations should be surveyed, anticipated and satisfied. Deming has mapped out the important advantages of quality, which are shown in figure 2.1.



**Figure 2.1 Advantages of Quality (from: Deming, 1986, p.3)**

However, Juran (1992, p.9) suggests that “*Quality is the fitness for use*”. In his definition, he looks at quality practically because the use of a product or a service is the most important aspect. It has even been suggested that a dangerous product could conform to all specifications but still be unfit for use (World Bank, 1992, p.71). For example, it is possible to think of a car which meets all specifications but where the braking system often fails after a give mileage.

Crosby, in his book *Quality is Free* (1979, p.9), defines quality as “*Conformance to requirements; it is precisely measurable; error is not required to fulfil the laws of nature; and people work just as hard now as they ever did*”. In his definition, he places an emphasis on the requirements of the stakeholder, which must be measured and met by the defined and adopted standards. Crosby also makes a crucial link between quality and leadership and management. He highlights the point that people perform to the standards of their leaders. He explains: “*if management thinks people do not care, then people will not care*”. A notable side of Crosby’s definition is that management is able to immediately quantify and measure quality.

These understandings of quality all relate to the world of business and production. Indeed, in these areas of life, it is often possible to quantify quality fairly precisely in terms of units produced per person or in terms of investment or time, the extent to which a product is fit for purpose, with some quantification of its reliability. It is not so easy to apply this kind of approach to the world of social provision: medicine, social work, police and, of central importance here, to education.

### 2.3 Quality in Education

In the field of education, reviewing the literature shows several attempts at defining quality in education. For instance Hoy *et. al.* (2000, p. 10) define quality in education as follows:

*“Quality in education is an evaluation of the process of educating which enhances the need to achieve and develop the talents of the customers of the process, and at the same time meets the accountability standards set by the clients who pay for the process or the outputs from the process of educating.”*

Thus, they consider quality as a tool for evaluating the educational process to meet the standards that are set by clients. At the same time, they consider the students to be customers and the parents as clients. Hoy *et. al.* add that both customers and clients are interested in the quality of the education provision, in the same way that local education authorities are also concerned about quality.

Their approach assumes that the ‘clients’ are equipped to evaluate the education provision. At school level, the problem is that the experience of parents of education is based almost entirely on their own past experience and this may simply be out-of-date. Indeed, it is based on a statistical sample of one - the parent - or, at most two, the father and mother. These parents may have enjoyed wonderful experiences or they may have

found school life totally unattractive. Inevitably, all this will colour their judgements of what is quality for their offspring.

Murgatroyd and Morgan (1993, p.45-50) state that there are three basic approaches to definitions of quality in education: quality assurance, contract conformance and customer-driven. Quality assurance refers to the determination of standards, appropriate methods and quality requirements by an expert body, accompanied by an inspection process that examines the extent to which practices meet the standards: for example, where a panel of experts on teaching might develop evaluation instruments that seek to itemize the characteristics of effective teachers.

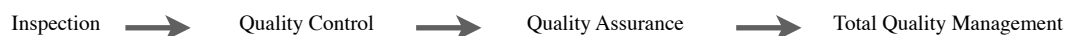
Contract conformance is where some quality standards have been specified during the negotiation of forming a contract: for example, the duties and tasks assigned for teachers by schools. However, it is not a simple task to specify the process of teaching in terms that allow for easy definition. Furthermore, such attempts would be likely to be reductive, limiting opportunities for learning. The customer-driven quality refers to meeting and exceeding the needs and expectations of customers. Students, for instance, can have some needs which must be taken into the schools' account to be satisfied. However, this begs the question as to whether the customers needs and expectations are an adequate picture of quality provision and also who determines these needs and aspirations.

From the review of the different definitions of quality, it is notable that quality is defined according to the author's background and profession. While there is no universal agreement on a definition for quality, there is general accord regarding the concept of quality and how stakeholder satisfaction and the existence of quality in all processes are important to retain customer loyalty, to reduce the cost of the products or services and prevent reworking of the processes.

It is important to note that quality can be said to exist when products or services meet the pre-defined specifications. “*Quality is not the end in itself, but a means by which the end product is judged to be up to standard*” (Sallis, 1993, p.23). This study emphasises developing the performance of a service organization and the approach derived from the world of business and production may prove to be very inadequate in this context.

Quality means the “*Degree of excellence a product or service provides*” (Beterfeild *et al.*, 2004). In the context of education, this is not very helpful. The ‘*product*’ could be seen as the learner or it could be seen as the educational provision. In either case, how can we quantify ‘*degree of excellence*’? This problem is also seen in looking at what Zuber and Ryan (1994) say when they state that quality means “*a characteristic, property or attribute that denotes a high grade, great excellence, accomplishment, or attainment*”. This seems to focus on academic performance but is this a genuine measure of quality of education. It assumes that the conventional measures of academic performance (mainly national examinations) reflect educational quality. That is a major assumption.

Reviewing the literature related to quality, there are four steps: inspection, quality control, quality assurance and total quality management. This is illustrated by figure 2.2 and this is discussed further on pages 29 and 36.



**Figure 2.2 Four steps in quality**

In thinking of secondary education, inspection often means inspecting schools, watching one or two lessons and looking at examination performance. The data obtained are then used to encourage (or force) the school to change aspects of its provision. This is an example of inspection leading to quality control.

It is often supposed that this offers some measure of quality assurance in the sense that the inspections are used to indicate quality for ‘consumers’. It is rare to find the idea of total quality management being involved. Indeed, total quality management must involve teachers fully and evidence suggests that most quality assurance procedures raise doubts with teachers at best and, more often lead to disillusionment and resentment (Robinson, 2010).

## 2.4 Quality in Secondary Education

“*Quality*” in secondary education is a term that is highly contested, considerably vague and highly contextual. Different interest groups attach different meanings to the term (Harvey and Green, 1993). Some common definitions include “*quality as excellence*”, “*fitness for purpose*” where quality is defined in terms of achievements of the desired outcome, “*as a philosophy for continuous improvements*” and “*value for money*” where quality is directly related to costs (Lagrosen *et al.*, 2004; Nightingale and O’Neil, 1994; Harvey and Green, 1993).

The confusion can be illustrated in figure 2.3.

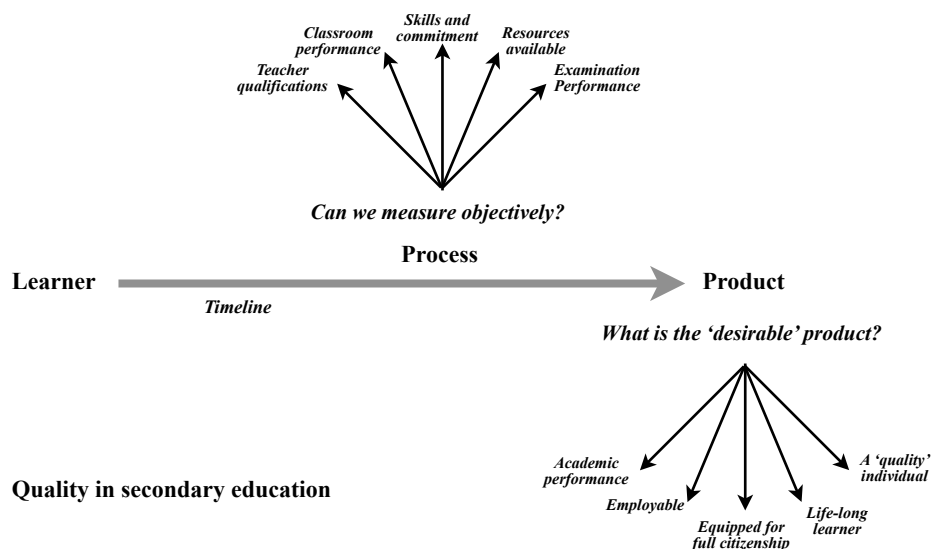


Figure 2.3 Quality in Secondary Education



The danger is that the focus is placed on what can be quantified easily. In this, examination performance is often used, along with considerations of costs, resources, and, very frequently, one-off observed lessons which conform to the expectations of the observers in some way. In fact, many of the features of quality interact and often in complex ways.

Abedor (1987) suggests that teaching improvement comes about through the interaction of three processes:

- ★ **Faculty Development:** Focuses on the knowledge, skills, sensitivities and techniques.
- ★ **Organizational Development:** Seeks to change the structure, policies and organizational environment in which instruction takes place.
- ★ **Instructional Development:** Focuses on the systematic design, development, implementation and evaluation of instructional materials, lessons, courses and curricula.

Recognizing the complexity of the interactions described by Abedor (1987), five aspects of quality are now considered on their own:

- ★ Quality of teachers.
- ★ Quality of students.
- ★ Quality of Curricula.
- ★ Quality of Infrastructure.
- ★ Teacher training programs

Each is now discussed in turn.

#### **2.4.1 Quality of Teachers**

In defining quality of teachers, there is also a need to recognize that the quality of the programmes depends to a large extent on the quality of the work of the teachers who deliver them. Teachers can interpret and apply intellectual standards in different ways and some teachers teach more effectively than others (Marginson, 2003).

UNESCO (1998) has argued that, in many areas in the world of work, the chief wealth of leading edge enterprises lies in the qualities of their human capital. This is all the more true for any secondary education establishment, so complex and demanding are the tasks (education and service) required of them. There is a need for the highest quality of teachers, people with not only great ability but a commitment to be involved positively with learners.

UNESCO (1998) go on to argue that the quality of teaching staff implies acceptable social and financial status. This is easy to say but not so easy to achieve, especially in developing countries. They also argue for the reduction of inequalities such as those relating to gender and a concern to manage staff in accordance with the merit principle, providing teachers with the in-service training they need, in order to fulfill their role in a changing society.

Stones (1994) has argued that quality teaching cannot be based on opinion. Nor can it be based on theoretical ideas suggested by those outside the classroom. The criticism here seems to be of the tendency in education to look for strategies that will solve all learning problems. There is sound research on the whole process of learning and the findings need to underpin what goes on in the classroom and this will be discussed in chapter 4. However, there is little place for advocacy of universal panaceas as Kirschner *et al.* (2006) have amply demonstrated. In the Kirschner review of the evidence, they show that many of the typical current strategies (such as constructivism, inquiry-based learning, problem based learning) do not, in fact, hold the answers. They are not universal panaceas although they may offer useful insights.

### 2.4.2 Quality of students

UNESCO (1998) note the importance of taking the quality of the school intake into careful consideration. The learners arrive in secondary education (age 15 in Bahrain) from diverse backgrounds. Of course, there will be diverse abilities and motivation. Some will have enjoyed considerable success previously and will be confident learners. Some will have the benefit of strong and supportive home environments. Many others, however, will have multiple disadvantages. Indeed, the intakes of no two schools will be identical and may vary widely from year to year.

Quddus (1990) proposed that quality cannot be maintained unless the students have the necessary ability and aptitude to pursue higher studies in the subjects which they choose. He argues for aptitude tests and proper guidance and counselling so that students do not waste their valuable time and the nation's precious manpower may not go waste. However, this all has cost implications and the use of such tests may be unhelpful for learners at ages 15-18 are developing and maturing at diverse rates, making any measurement at one point of time highly unreliable.

Student capability is developed as much by learning experiences as by specific content of courses. If students are to develop justified confidence in their ability to take purposive and sensible action, and to develop confidence in their ability to learn, belief in their power to perform and proven power of judgment in unfamiliar situations, many things are needed. They need real experience in being responsible and accountable for their own learning, with the rigorous, interactive, supportive and, for them, unfamiliar environment of secondary education. Stephenson and Yorke (1998) argue that schools need to develop attitudes of being responsible for their own learning. This may bring about an increased confidence in their ability to take effective and appropriate action, to explain what they are about, to live and work effectively with other people, and to

continue to learn from their own experiences. In simple terms, schools are far more than places where knowledge is poured into the heads of learners.

### 2.4.3 Quality of Curricula

The quality of the overall curriculum as well as the quality of each specific subject curriculum both need careful attention. UNESCO (1998) note the importance of taking into account the requirements of the world of work and the needs of wider society. They stress the need to emphasise learner involvement, with full mental engagement in the tasks undertaken. They see the developing role of IT and the potential in the internationalization and networking of curricula, students and teachers.

In all this, there are important questions: who decides the curriculum for each subject area and on what basis? How is curriculum balance to be developed to give a coherent and meaningful overall learning experience?

Historically, most subject curricula are determined by teams of subject '*experts*' who, inevitably, are very committed to the subject. Thus, it is normal for subject curricula to be planned to reflect the logic and progression of knowledge in that subject. Another strong factor in developing a subject curriculum is the perceived needs of the next stages of learning. Thus, what is needed for an honours degree determines what is taught in early university years which, in turn, determines what is taught at later school stages, and so on. Reid (2010) has demonstrated the weakness of such an approach which, effectively, determines what is taught at school level by the needs of a tiny minority.

Johnstone, in the context of one major subject area has demonstrated that the curriculum should take into account the psychological needs of the learners rather than the logical needs of the subject (Johnstone, 2000). Reid (1999, 2000) has reviewed the

effectiveness of what he calls the ‘*applications-led*’ curriculum in developing positive attitudes. In such a curriculum, what is taught is planned to enable the learners to make sense of *their* world at *their* stage of development. Numerous such curricula exist today eg. physics curricula in the Netherlands, the Scottish Standard Grade physics curriculum. In addition, Reid (1999, 2000) has offered exemplars of the approach.

This is a major area of secondary school education. Teachers can only operate within the confines of the curriculum given to them while schools can only offer a curriculum balance determined by national policies.

#### **2.4.4 Quality of Infrastructure**

Quality of education and research assumes the existence of an adequate physical infrastructure that matches needs. It also assumes, however, that such infrastructure is maintained and managed in the best possible way for each institution and not mainly for the convenience of the managers.

These conditions are far from being met in too many higher secondary education institutions. In some institutions in developing countries, the libraries are now no more than book deposits dating back more than ten years, laboratories are rooms with out of date equipment which is particularly useless because the basic items for experiments are lacking, lecture halls are designed for half or one third of the numbers using them. Even paper can be a rare commodity in schools, requiring long, costly and often fruitless efforts to obtain (UNESCO, 1998).

The quality of infrastructure of the internal and external environment needs to take into account the rapidly developing use of IT (UNESCO, 1998). This can open the door of opportunity and experience to learners in ways not envisaged a few decades ago. However, it is expensive.

Investment in the development of the physical facilities of an institution go a long way in improving the quality of education while the Asian model developed by UNESCO recommended one third of the educational for budget for capital outlay (Natarajan, 1990).

#### **2.4.5 Teacher training programmes**

This is a very large area which may influence quality considerably. There are two aspects: initial teacher education; continuing professional development (formerly in-service training). There are key issues here and, at least in Bahrain, teachers complain considerably about the training offered to them. Teachers repeatedly in Bahrain ask for training related to the improvement of teaching skills, often subject specific, and training provided by those who have credibility in the classroom.

There are two interrelated aspects. The training and development must be relevant to what goes on the learning situations and those who offer the training must have classroom credibility. Considering quality, no country would ever spend money on pre-service teacher training if it did not believe that such training enhanced quality. However, where is the evidence? Furthermore, no country would ever spend money on in-service teacher training if quality enhancement was not a goal.

School inspections in Bahrain reveal some worrying signs (the researcher was often involved in conversation with teachers who raised legitimate worries). Teachers want systematic training and they are not clear about aims in what they are being asked to do. They are not clear about how to improve students performance. They need help to see the quality assurance as a coherent, integrated learning experience, linked tightly to classroom teaching and how quality is to be assessed. Almost certainly, they need help to grasp the ways of using new methods in teaching with which they are not familiar: a

major paradigm shift. All of this raises questions about the quality of training currently offered and, perhaps, the credibility of those offering it.

#### 2.4.6 ‘Quality’ teaching, ‘Good’ teaching, and ‘Successful’ teaching

This issue of quality teaching is taken up by Fenstermacher and Richardson, in ‘*On making determinations of quality teaching*’, published in the Teachers College Record in 2005 (Fenstermacher and Richardson, 2005). Their arguments present a fresh analysis of the relationship between teaching and learning which allows for a degree of causality between teaching and learning.

The authors set out to define ‘*quality*’ teaching and ways in which it may be recognised:

*“What constitutes the keen insight and quality judgement needed to pick out instances of quality teaching? Can we ‘unpack’ the conceptual subtleties and nuances of quality teaching so that we can proceed in consistent and systematic ways to identify and foster it, or are we required instead to acknowledge its elusive nature and depend on some sort of cultivated intuition to reveal quality teaching?”* (p. 186–187).

Like McAninch (1993), these writers apply Ryle’s (1949) ‘*task and achievement*’ distinction to the verbs ‘*teaching*’ and ‘*learning*’ and agree that teaching (the task verb) does not necessarily entail learning (the achievement verb).

When considering task and achievement verbs, Fenstermacher and Richardson caution against sliding into the conceptual fallacy that teaching per se could only be said to be occurring when students were learning, and suggest that quality teaching might entail successful teaching; that is, teaching that had caused learning to occur.

*“Quality teaching could be understood as teaching that produces learning. In other words, there can indeed be a task sense of teaching, but any assertion that such teaching is quality teaching depends on students learning what the teacher is teaching. To keep these ideas clearly sorted, we label this sense of teaching successful teaching. Successful teaching is teaching understood exclusively in its achievement sense. This said, the question is whether successful teaching is what we mean by quality teaching.”* (p. 189)

When making a judgement about quality, describing an act of teaching as ‘*successful*’ is clearly insufficient as an assessment of ‘*quality*’. Children could be taught to kill successfully, to lie, to cheat, but no one would describe such teaching as ‘*quality*’. And even if the content were acceptable, such as teaching the causes of World War II or how to calculate the mass of an electron, the teacher might beat the children, or drug them to learn. Such teaching would never attract the adjective ‘*quality*’.

Fenstermacher and Richardson (2005) argue that ‘*quality*’ teaching must include considerations not only of what is taught, but how it is taught. Such teaching may be called ‘*good teaching*’:

*Quality teaching, it appears, is about more than whether something is taught. It is also about how it is taught. Not only must the content be appropriate, proper, and aimed at some worthy purpose, the methods employed have to be morally defensible and grounded in shared conceptions of reasonableness. To sharpen the contrast with successful teaching, we will call teaching that accords with high standards for subject matter content and methods of practice ‘good teaching’. Good teaching is teaching that comports with morally defensible and rationally sound principles of instructional practice. Successful teaching is teaching that yields the intended learning. (p. 189)*

Teaching may thus be seen as capable of being good without being successful, or successful without being good: ‘*Good teaching is grounded in the task sense of the term, while successful teaching is grounded in the achievement sense of the term*’ (Fenstermacher and Richardson, 2005, p. 189). These distinctions matter when it comes to the writing of standards to be used in the assessment of teaching performance. Should standards and assessments focus on evidence of student learning outcomes, or the quality of the conditions for learning that the teacher has established?

Fenstermacher and Richardson (2005) offer a clear analysis of the issues and they undermine the view that evidence of good teaching can be found by looking at the learning gains. Explicitly, they also undermine the current fashion of judging teachers, schools and countries on the basis of examination performance and this is now discussed further.



### 2.4.7 Conditions for learning

It would be tempting at this point, say Fenstermacher and Richardson (p.190), to conclude that ‘*quality teaching*’ is some kind of simple combination of ‘*good*’ and ‘*successful*’ teaching but that argument is ‘*fraught with complexities*’. For a student to succeed in learning four conditions need to be in place:

- \* Willingness and effort by the learner.
- \* A social surrounding supportive of teaching and learning.
- \* Opportunity to teach and learn.
- \* Good teaching.

If these conditions are valid, they continue, then good teaching is but one of the factors that relate to the achievement verb ‘*learning*’. ‘*Successful*’ teaching, which posits a relationship between teaching and learning, thus depends upon more than ‘*good*’ teaching; it requires the presence of at least three conditions that are outside the control of the teacher. For this reason, they argue, policy related to teaching standards and teacher evaluation that presumes a simple relationship between learning and teaching is misguided:

*There is currently a considerable focus on quality teaching, much of it rooted in the presumption that the improvement of teaching is a key element in improving student learning. We believe that this policy focus rests on a naïve conception of the relationship between teaching and learning. This conception treats the relationship as a straightforward causal connection, such that if it could be perfected, it could then be sustained under almost any conditions, including poverty, vast linguistic, racial or cultural differences, and massive differences in the opportunity factors of time, facilities, and resources. Our analysis suggests that this presumption of simple causality is more than naïve; it is wrong. (p. 191)*

Their observations are based on extensive evidence. They raise a fundamental issue. Assuming that quality learning is neatly related to quality teaching ignores the fact that not all school students ‘*want*’ to learn, or are capable of learning what is placed before them, not matter how good the teaching may be.

## 2.5 The Nature of Quality Assurance

The last section explored some issues relate to the nature of quality and how it can be described. This section now turns to quality assurance itself.

Seymour (1992) points out that the concept of quality assurance was applied to manufacturing between 1950s and 1980s. The process concentrated on the entire production process in order to prevent quality failure (Sallis, 1993) and to ensure that the products were produced to a predetermined specification.

Aspin *et al.*, (1994) note how the same approach started to move across into education in the 1980s. The problem is that quality in education is difficult to describe in operational terms while the complexities of the teaching-learning process are extremely difficult to specify.

In looking at quality, Hoy *et.al.* (2000) transferred the ideas from manufacturing and saw the learners to be customers and the parents as clients. Zuber and Ryan (1994) state that quality means '*a characteristic, property or attribute that devotes a high grade, great excellence, accomplishment, or attainment*', thus limiting quality evidence to academic performance.

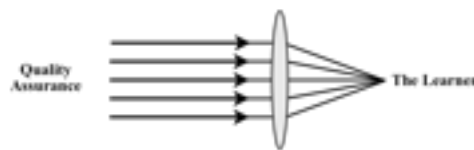
While '*quality*' in secondary education is a term that is highly contested (Harvey and Green, 1993), quality assurance can be described as:

*All those planned and systematic activities to provide adequate confidence that a product or service is satisfying given requirements of quality.*

This is easy to say. However, while widely accepted, this statement raises numerous questions itself:

- 👤 What is the '*product*'?
- 👤 What is the '*service*'?
- 👤 What are '*adequate requirements*'?

The ‘*product*’ can be seen in terms of the learners and what they have gained from their journey through education. A ‘*service*’ has been offered to them and the question is the extent to which that service has changed them educationally so that they can be seen to have achieved what they are capable of achieving. The nature of the ‘*requirements*’ is, however, even more difficult to describe. However, in all of this, the focus must be relentlessly on the learners (Figure 2.4).



**Figure 2.4 Learners at the Focus (derived from Reid, 2009)**

The danger in all quality assurance is that the easy-to-measure peripherals are the focus. Instead, the focus must be relentlessly on the learners, their experiences in learning as learners and the nature of the final ‘*product*’. Thus, quality assurance needs to be seen in terms of the extent to which the agreed goals have been reached by learners. Here are some broad goals which seem to be broadly agreed across the literature (Figure 2.5):



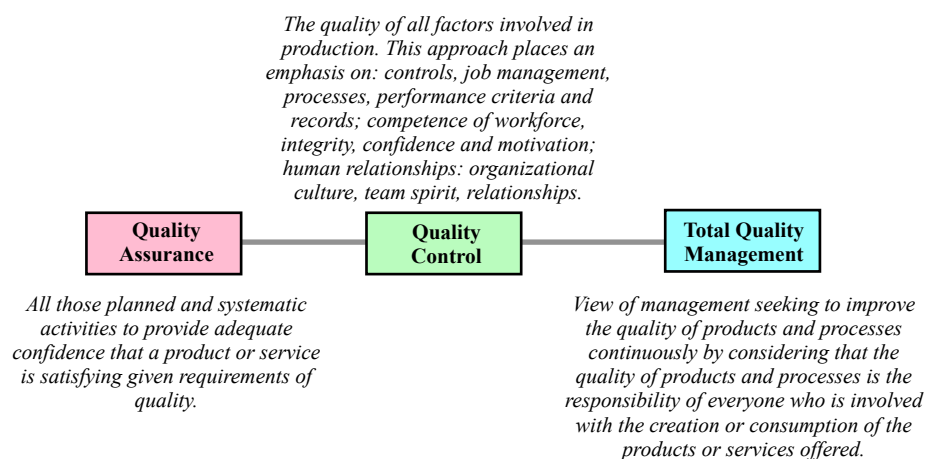
**Figure 2.5 Four Goals**

The first goal relates to the extent to which individual student potential is released. The second recognises that learners will have a role in the workplace, making a contribution to the nation. The third relates to the key role of all education in increasing knowledge and understanding and making that available to wider society while the fourth is more imprecise but extremely important: learners will have a role in contributing to the society of the future.

## 2.6 Descriptions of Quality Assurance

Sallis (1993) argues that quality assurance is considered the third step in the evolution toward total quality management and is different from quality control: quality assurance is evident before and during the event process. He goes on to state that the concern of quality assurance is about preventing faults occurring in the first place. Quality is designed into the process to ensure that the products are produced to a predetermined specification. Sallis argues that the quality of the good or service is assured by there being a system in place, known as a quality assurance system, which lays down exactly how production should take place and to what standards. Quality assurance, then, is a managerial process that can be applied to all manufacturing processes and aims to achieve quality through preventing faults. However, quality assurance too has its limitations as it may specify how things should be done in the current context but is limited in the scope to improve or enhance.

The key descriptions can be described as in figure 2.6.



**Figure 2.6 Some key ideas**

The focus on quality has continued across business and commerce as well as public services such as education and health. There has been a development from a narrow construction as quality control to a more developed understanding of the process of

change and improvement. In order to survive in an increasingly global marketplace, the issue of customer satisfaction as part of quality was required. Consequently, total quality management was born.

Despite the growing concern about the quality of education, crystallising an agreed definition is somewhat difficult largely due to a wide array of stakeholders and consumers along with the complexities of teaching-learning process which need to be unfolded continuously (Aspin and Chapman, 1994). Indeed, it raises the question about whether a model of quality derived from manufacturing is appropriate for an area like education. In addition, terms like effectiveness, efficiency, equity, equality and quality are often used interchangeably.

The literature shows that different organizations have differed in their descriptions of quality assurance and, of course, different definitions show an obvious variety in understanding of what quality assurance is (Brennan and Shah, 2000b). They also impact on the purposes and functions of quality management systems. Dale (1990, pp. 24-26) argues that:

*“Quality assurance can provide confidence that quality requirements will be fulfilled through advanced quality planning, training, critical problem-solving tasks, enhancing design of product, process and services, promoting control over the process, and involving and motivating people.”*

This seems to be almost a ‘*catch all*’ description and raises more questions that it solves. What is meant by quality planning? What are critical problem solving tasks? How do we promote control over the process? Indeed, this kind of approach has little relevance in education and tends to hide important ideas with endless jargon.

Oakland (2000) suggests that quality assurance is a continuous and never-ending process, comprising systematic approaches and activities to enable a confidence in products, services, and systems. Siebels (2004) notes that systematic approaches and

recommendations have been propounded in the literature for ensuring and improving quality. He argues that quality assurance in the industry sector is:

*“All the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence of product or service will fulfill requirements for quality” (p.193).*

A similar definition of quality assurance is evident in the relevant specifications for managing and enhancing quality offered by the International Organization for Standardization (ISO). ISO is a specialized, international and non-governmental agency founded in 1947. It comprised the national standards bodies of 148 countries in 2004.

ISO works to develop technical standards for products and services sold around the world (Eldridge, 2006). In terms of ISO 9000 (2005), quality assurance is defined for industry and business sector as:

*“A set of activities whose purpose is to demonstrate that an entity meets all quality requirements. Quality assurance activities are carried out in order to inspire the confidence of both customers and managers.” (ISO 9000, 2005, p.5)*

All this applies mainly to production of physical products and services. When carried over into education, it generates all kinds of problems for it is not easy to specify what is the equivalent to the ‘*product*’ from some production line. Thus, when early quality assurance was first introduced into the Higher Education system of the UK in the early 1990s, the Higher Education Quality Council (HEQC) defined what quality assurance meant in higher education. The HEQC was an agency owned by the British institutions through their representative bodies. It conducted assessments at the university level in the UK between 1992 and 1997. After 1997, the Quality Assurance Agency (QAA) took over HEQC’s functions (Brown, 2004). The HEQC’s definition is as follows (HEQC, 1994, p.61):

*“Quality assurance is all those planned and systematic activities to provide adequate confidence that a product or service will satisfy given requirements for quality.”*

This has already been criticised in that it is almost impossible to quantify the product or the service in a meaningful way.

In New Zealand, regular quality audits in universities commenced in 1993. As an independent body owned by the New Zealand Vice-Chancellor's Committee to carry out audits of quality assurance processes at the universities, the New Zealand Universities Academic Audit Unit (AAU) explains:

*"Quality assurance may be defined as the policies, attitudes, actions and procedures necessary to ensure that quality of education and scholarship are being maintained and enhanced. It includes checking that quality control procedures are in place, are being used and are effective. It requires actions internal to the institution, but may also involve actions of an external body or bodies. It includes course design, staff development, and the collection and use of feedback from students and employers."*

(Woodhouse, 1998, p.3).

Like so many documents on quality assurance, the process is described but exactly what are the marks of quality itself are rarely specified.

Since the early 1990s, on the one hand, quality assurance has been broadly introduced into and implemented at universities in advanced countries and transition countries, as well as some developing countries (Vidovich, 2002). On the other hand, in the last decade, quality assurance in higher education has been actively supported and promulgated by international organizations such as the OECD, the World Trade Organization (WTO) and the World Bank (Taylor, 1997; Vidovich, 2002; Altbach, 2001).

The United Nations Educational Scientific and Cultural Organization (UNESCO) is also a strong advocate of quality assurance for higher education. UNESCO has held a global forum every two years on international quality assurance since 2002. It states that:

*"Quality assurance is the systematic review of educational programs to ensure that acceptable standards of education, scholarship and infrastructure are being maintained."* (UNESCO, 2001, p.2).

Again, the process is described but exactly what are the acceptable standards are not operationally described.

The above statement on quality assurance by UNESCO (2001) applies the theory of quality management to education and stresses the importance of “*systematic program review*” for meeting acceptable standards, rather than “*planned and systematic activities*” around providing customer confidence. This shift in emphasis reflects what UNESCO (2001) understands about quality assurance and provides a more appropriate view on how it would be conducted in an academic context.

In addition to the national developments, quality assurance for higher education is supported and disseminated by international organizations that are specifically concerned with quality assurance. They are increasingly involved in the global networks and associations which emerged in the 1990s. The International Network for Quality Assurance Agencies in Higher Education (INQAAHE) was established in 1991. Its main role is to exchange information and experiences in the assessment, improvement and maintenance of quality in higher education. It is also an organization that assists in the professional development of higher education workers. INQAAHE states:

*“Assurance of quality in higher education is a process of establishing stakeholder confidence that provision fulfills expectations or measures up to threshold minimum requirements. It embraces input, process and outcomes.”* (INQAAHE, 2005, p.3).

However, how to describe ‘*threshold minimum requirements*’ is far from easy. Does this relate to what is being provided in terms of things like length of courses, depth of course, assessment procedures, support available or does it relate in any way to the actual learner experiences in the sense that they fulfill specific criteria, are relevant to learner needs and move the learner forward in educational terms in specified ways? The range of criteria is extremely large and there needs to be a specification of priorities and critical features.



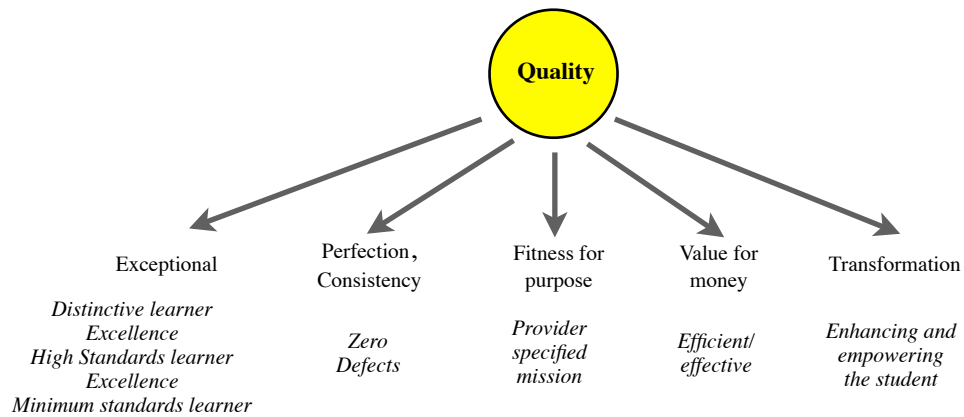
As cited in Watty (2003), a further review of the literature around change in higher education reveals two schools of thought:

- \* *The first attaches quality to a context and as a consequence quality becomes meaningful (Baird, 1988; Fry, 1995; Nordvall and Braxton, 1996). For example, references to the quality of assessment, student intake, academic programmes, teaching and learning, the student experience and programme designs are not uncommon. Any attempt to define or attach meaning to the term is largely ignored and one is left to assume that it is 'high' quality that is being referred to as opposed to 'good' or 'poor' quality.*
- \* *A second way of thinking about quality relates to a stakeholder-specific meaning. Here quality is considered, having regard to a variety of stakeholders with an interest in higher education, each having the potential to think about quality in different ways. In particular, the early works of Vroeijenstijn (1995), Middlehurst (1992) and Harvey and Green (1993) highlight the importance and value of considering quality from a variety of stakeholder perspectives.*

Harvey and Green (1993) identify five categories or ways of thinking about quality. As cited in Watty (2003) key aspects of each of these categories can be summarised:

- \* *Exception: distinctive, embodies in excellence, passing a minimum set of standards.*
- \* *Perfection: zero defects, getting things right the first time (focus on process as opposed to inputs and outputs).*
- \* *Fitness for purpose: relates quality to a purpose, defined by the provider.*
- \* *Value for money: a focus on efficiency and effectiveness, measuring outputs against inputs. A populist notion of quality (government).*
- \* *Transformation: a qualitative change; education is about doing something to the student as opposed to something for the consumer. Includes concepts of enhancing and empowering: democratisation of the process, not just outcomes.*

Figure 2.7 presents this approach more visually.



**Figure 2.7 Definitions for quality**  
(Derived from: Watty, 2003 p. 215)

Watty (2003) suggests that the dimension of quality as perfection can be removed, since higher education does not aim to produce defect-free graduates. Lomas (2001) suggests that fitness for purpose and transformation seem to be the two most appropriate definitions of quality, according to small-scale research with a sample of senior managers in higher education institutions.

## 2.7 Developments in Quality Assurance.

The origins of quality assurance can be attributed to developments in the manufacturing and industrial sector and Garvin (1988) and Dale (1990) demonstrate the evolution of quality management and identify “Inspection”, “Quality control”, “Quality assurance” and “Total quality management” as four different stages in the evolution of quality management. Each is now discussed in turn.

### 2.7.1 Quality inspection

Quality assurance in its original form was inspection-oriented, based on a simple check-list based system of quality management (Garvin, 1988) and, until the early 1900s, inspection was still thought to be only way of ensuring quality (Bounds, 1994). Dale (1990, p 22) defines the concept of inspection as follows:

*“Under the quality system, one or more characteristics of a product, service or activity are detected, measured, and compared with specified requirements to assess whether they conform to the relevant specifications or standards.”*

A major attribute of inspection is that it occurs only after a process of production has been completed or partly completed. If, however, a large number of defective products has been produced, the scrap or rework costs would be high and this is a disadvantage of inspection (Summers, 1997). Inspection lacks a link with efficiency (Garvin, 1988); as a tool of quality management, it is hard to satisfy the requirements of mass production of products (Dale, 1990).

In education, many aspects of quality assurance have to move beyond an inspection type of process. Indeed, in schools in many countries, school inspections still form the basis for addressing quality. Check lists may not always be used but performance indicators have replaced them.

### **2.7.2 Quality control**

In the 1930s, the use of statistical quality control was adopted in quality management of product, and is the second stage in the evolution of quality management (Garvin, 1988; Dale, 1990; Summers, 1997). In the quality control era, relevant information, tools and techniques were used to ensure that only conforming products and services were delivered to the customer (Dale, 1990).

Quality control goes beyond inspection by four activities that work together to improve quality of products or services. The activities include setting up standards for the product or service, ensuring processes of production to conform to these standards, taking action in the quality control if there is any lack of conformance to the standards, and implementing plans to prevent future nonconformance (Summers, 1997, p.9).

Garvin (1988) argues that typical quality control management uses “*process control chart*” and “*sampling*” techniques. It can effectively find defective products without greater consumption of cost and time. However, quality control has its disadvantages as well. It is still operated in a detection-type mode (Dale, 1990), finds and solves a problem during and after the process of production, and also does not prevent mistakes from arising in the first place (Richardson, 1997).

In some countries, the process of school quality assurance resembles quality control in many ways. There is an attempt to identify what are known as ‘*failing schools*’ and these are closed or amalgamated to prevent the further production of faulty ‘*products*’. Sometimes there is a ‘*naming and shaming*’ process (Ofsted, undated). There is little attempt to look at the curriculum or assessment systems imposed from outside and often no account is taken of the previous education of the learners or the kind of environment where they grow up and may seek their first job (if any job is available).

### 2.7.3 Quality assurance

Quality assurance also emerged as a principal methodology of management in the industry and business sectors throughout the 1950s and in the early 1960s as the third stage in the evolution of quality management (Bounds, 1994). As a prevention-based system, a principal advantage of quality assurance is that this system can stop non-conforming product and service being produced and delivered in the first place by “*concentrating on source activities and integrating quality into the planning and design stage*” (Dale, 1990, p.25).

Contrary to the earlier emphasis on post-production inspection, Richardson (1997) indicates that quality assurance is “*strongly preventative in nature*” (p.50), because quality is created in the design stage and not at the later control stage. Under this

system, each worker has a responsibility in reducing non-conformance. Dale (1990) also argues that this is a clear change of emphasis “*from downstream to the upstream process and from product to process*” (p.25). Also, quality assurance brings a clearer and deeper sense of responsibility for quality, and eliminates the root cause of waste and non-value-adding activity in the processes of production and service delivered (Juran, 1995).

Quality assurance primarily focuses on “*co-ordination*” rather than “*detection*” or “*control*”. It aims to ensure quality of product and service, and improve the confidence of the consumer through “*zero defects*” (Garvin, 1988, pp.16-20). Techniques of quality assurance mainly embrace creating quality management systems, establishing quality standards and executing quality audits for product, process and service (Fox, 1993).

In school education, there is a lack of this kind of more preventative approach. National curricula and assessment systems are often determined politically, with little reference to any evidence. Thus, the core of school life may well be determined by learning experiences and assessment processes which are highly inappropriate.

#### **2.7.4 Total Quality Management**

Quality assurance was rapidly popularized in industry and the business world in the 1970s (Drummond, 1992; Bounds, 1994). More recently, Total Quality Management (TQM) appeared in quality management and has been interpreted as the fourth stage or the TQM era (Garvin, 1988; Dale, 1990). Richardson (1997) argues that TQM broadens the idea of quality assurance to include every function of the organization towards achievements of the organization’s purposes. The TQM system emphasizes an organization-wide effort to establish a climate for continuous improvement in products and services.

The rapid evolution from quality assurance to TQM reflects and responds to the new requirements that adopt “a new operating philosophy, approach, management style and way of thinking” to enable “various departments and functions to smoothly work and act together in cross-functional teams to discover the root cause of problems and pursue their elimination” in quality management in the industry sector (Dale, 1990, pp.25-26).

The evolution of quality management in the manufacturing sector demonstrates three essential assumptions and ideas that embody accountability, customer satisfaction, and continuous improvement in quality and efficiency (Harvey and Knight, 1996). Importing these into education might lead to a greater concern about conflicts and tensions around the management of staff, students, teaching and research.

## **2.8 Globalization and Quality**

The challenge of globalization with its connected characteristics of expanding economic, cultural and political networks of affiliation and association across national borders around the world is now fully articulated to education system. Moreover, the advancement of knowledge and technology introduces another challenge in thinking about the consequences of technology uses and the mass knowledge for the learning opportunities and outcomes of students and the need for developing the education system in Bahrain to be able to deal with these external challenges.

One of the significant areas of concern in the education is the issue of globalization. Rapid globalization is one of the most salient trends of the new millennium. It is a multidimensional, multilevel phenomenon and is a too broad and ambiguous term to be defined easily. There are a large number of studies focusing on globalization; they differ in their concentration on a particular set of consequences or in their consideration of globalization in distinct ways. Many studies emphasize its treatment as economic

globalization (Panic, 2003) or as technological globalization (Schultz and Kitchen, 2000). Moreover, some of the studies look at the antecedent and concurrent political forces shaping the processes of globalization (Stromquist 2002, Daun 2002). In addition, a few of the studies focus on the socio-political impact of globalization primarily on developing countries (Mittelman, 2000). There is also an enormous number of studies that discuss the impact of globalization on education (Stromquist, 2002; Carney, 2003 and Dale and Robertson, 2002).

Although each of these studies deals with globalization from a certain point of view, most of the studies share something in common. These studies present globalization as a multidimensional process that involves multinational organizations. There is another aspect of globalization beyond the existence of organizations that sit across national boundaries. Globalization is operating at a political and cultural level with areas of concern such as climate change, depletion of resources as well as significant exchanges of ideas, beliefs, art and cuisine with the possible emergence of a '*global culture*'. These trends signal an increase in interconnection and argue that there is a growing interdependency between nations, companies, organisations, individuals and so on. Tabb's definition (1999) is particularly useful in this context. He defines globalization as "*a process of reducing barriers between countries and encouraging closer economic, political, and social interaction*"(p.1). A more expansive, but basically similar formulation is put forward by Torres (2002): "*globalization not only blurs the national boundaries but also shifts solidarities within and outside the national state*" (p.363).

Cox (1996) goes even further into the impact of globalization on social structures. He argues that globalisation has significant social consequences and can cause social division and creates contradictions of a three part hierarchy in social structure: (1) a top layer of people who are integrated into global economy; (2) a category of people serving those directly involved in global affairs and (3) those who are excluded from the

global economy (Daun, 2002, p.5). According to Cox's taxonomy, globalisation is highly favourable to industrial countries but, for the developing countries, there is a real danger that globalisation will mean economic stagnation and marginalization.

According to some researchers (eg. Panic, 2003 and Carney, 2003) globalization has various positive impacts. It is creating enormous opportunities for sharing social values and behavioural norms and promoting development at various levels including individuals, organizations, societies across different countries whether industrialised or developing. Another constructive impact of globalization is the mutual support and benefit to produce synergy for numerous developments of countries, communities and individuals (Cheng, 2002, p.7).

Prasad *et.al.* (2003, p.8), in their report about the effects of financial globalization on developing countries to the International Monetary Fund, claim that globalization could help to raise the growth rate in developing countries through some direct channels such as: augmentation of domestic savings, reduction in the cost of capital, transfer of technology from advanced to developing countries and the development of domestic financial sectors.

Globalization could also help developing countries through indirect channels, which in some cases, could be even more important than the direct channels, such as, the increased production specialization in both macroeconomic policies and institutions induced by competitive pressures or the “*discipline effect*” of globalization. Prasad *et.al.* (2003, p.8) also reveal that the average income for the group of more financially open (developing) economies does grow at a more favourable rate than that of a group of less financially open economies. However, at the same time, globalization could potentially have a serious negative impact on indigenous development particularly for developing countries.



Furthermore, globalization can exacerbate inequalities so as to render groups within developing countries, and groups of countries themselves, both poorer economically and not able to influence their roles politically (Woods, 2000, p.9). In other words, globalization is continuing the dominance of advanced countries over developing countries and indeed increasing the gaps between rich and poor areas in all over the world. Thus, Chan (2001) notes that, “*the less developed countries and communities remain stagnant economically, socially and even politically*” (p.168). Globalization then has two facets, positive and negative, and it is important to consider both of these while dealing with globalization.

Turning to the impact of globalization on the world, the situation is significant particularly in terms of economic development in a highly competitive global economy. With the advent of globalization, educational institutes must begin to transform themselves in order to meet the recent demands. The challenges of globalization permeate and shape the education system so the latter can help to support, maintain and reproduce the development in other fields. The importance placed on globalization in education is not accidental. First, economic globalization places an emphasis on the creation of a skilled labour force and educational policy makers must be responsive to business needs through the educational system.

Worldwide, the effects of globalization vary across and within countries and institutions so that the responses to it also fluctuate. In their editorial essay ‘What Does Globalization mean for Educational Change? A Comparative Approach,’ Carnoy and Rhoten, (2002) stress that in assessing the impact of globalization on educational change, it is imperative to “*know how globalization and its ideological packaging affect the overall delivery of schooling, from transnational paradigms to national policies to local practices*” (p.2). The current phenomenon of globalization provides a real empirical challenge as much as it does a theoretical frame for reforming education. In

conclusion, the educators must acknowledge these forces and consider their consequences to reshape and reform the educational system. Therefore, one of the issues that needs to be considered in the development of the education system is globalisation.

Although it is true that external challenges are often the cause or at least the impetus for most educational development, the internal challenges play a great role in forcing the improvement. In the world, there are many internal challenges that require the development of education. Some of these internal challenges are related to the educational organisation such as the aspiration for development of the education system to support a changing society.

The demand for the development of education is also challenged by the desire to repair a widening divide in the social fabric in society and the aspiration for quality. Surmounting the challenges mentioned above, there is the urgent need for education to help in treating some social problems such as poverty and to provide equality in the workforce. Gregory (2001, p.404) states that a basic goal of educational planners in developing countries has always been increasing the quantity of the enrolments, but in these days increasing the level of educational quality has also become the goal.

Globalisation has made all countries much more aware of what others are achieving. In turn, this drives an agenda for improvement and generates incessant change.

## **2.9 The Importance of Management of Change in Education.**

As a consequence of the previously mentioned challenges, the traditional and familiar ways of doing things are changing and there is a demand for more qualified, skilful and knowledgeable workers. There is also a need for a vision for teaching and learning that equips students to be able to deal with the current and future challenges.

Change then is endemic within society, certainly within education. In fact, it can be argued that change is a much more ‘*natural*’ situation than one of stability. Change, as Whitaker (1993, p.49) defines it, involves moving from a present state to a different future one. It requires new knowledge and skills to enable organizations to adapt successfully to new requirements. As far as educational change is concerned, the meaning will not always be clear. This is probably due to the complex nature of education systems. The view of change in education, according to Oliver’s opinion (1996, p.6), must involve the establishment of new targets and strategies. However, change is not just about the creation of new policies and procedures, but it is important that change agents, students, teachers, administrators, parents and employers, are involved. This is because they know the different facets of the education system and among these stakeholders there are some who seek change and who will take change forward. A change process has to take into account the different dimensions of the system. Peeke (1994, p.26) emphasises this aspect of a system:

*“A specific characteristic of the systems view is its emphasis on the interrelatedness of the various parts of the system. Change in one part of the system necessitates change in all other parts also.”*

Moreover, feelings and emotions are of primary significance in change. The functional structures by which change is created are extremely important in developing an atmosphere in which people can feel part of the change process (Oliver, 1996, p.5).

In terms of the importance of change management in education, it could be considered as a defensive response to the perceived threats of competitors. Hannan (2001, p.1) stresses that *“If we don’t change and change rapidly, others will thrive at our expense”*. Change also appears to be a means to solve urgent problems, particularly those associated with social and economic pressures. Furthermore, Fullan (1993, p.4) argues that the promise of educational change has a moral purpose: to make a difference in the

lives of students regardless of their backgrounds and help produce citizens who can live and work productively in increasingly dynamically complex societies.

However, a major issue is whether the incessant drive for change (often described as educational reform although there is often no evidence that it does reform in a positive sense) increases quality. This is another factor in the quality assurance agenda.

## **2.10 Reasons for Developing Quality Assurance**

In the mid 1980s, quality assurance was introduced into the education sector by governments in most OECD countries, while the public sector in these 23 countries was introducing total quality management for improving accountability and effectiveness in the use of public resources and delivery of public service. Quality assurance from its origins in management has become increasingly influential in higher education (Taylor, 1997).

Kern (1998) and Edwards (2004) argue that the main reasons that saw the introduction of quality assurance were globalization and public management reform arising in the last decades of the 20th century. However the latter was probably the major influence, at least at the outset. There was a political move in the UK and the US to see public service as wasteful and a drain on the economy. Public service lacked competition and this was seen as having the ability to drive up standards.

Globalisation was seen in terms of multinational activities and making supranational connections (Hobsbawn, 1994; Singh, Kenway and Apple, 2005). Cross-border connections provided an opportunity for higher education to accommodate its developments as part of the new global realities (Altbach, 2002) and this started to filter down to school level, with the development of international league tables of performance. Governments tended to use a high placing on such league tables to

congratulate themselves, while a low place was used as a means to criticise education provision and, specifically, teaching professions.

Higher education was seen as an engine to improve economic and life quality, with advance techniques and knowledge innovation (Kell, 2004; King, 2004a; Yorke, 2000; Vidovich, 2002). Loganathan and Sivagnanam (2003) argued that developed countries saw higher education as a means to make an economy globally competitive by training students for employment in knowledge economy and to promote social inclusion by enhancing opportunities for a wider section of society to obtain higher education. The effect on secondary education was to emphasise the achievement of high grades and thus gain access to higher education.

The political drive changed the nature of higher education where, traditionally, knowledge was pursued for its own sake, seen as having value in itself. The transition from elite to mass higher education became a significant global trend since the 1980s (DEET and OECD, 1993) and this mass higher education has been oriented as a system that aims at the primary goal of high-level skills training on a cost-effective basis (Taylor, Barr and Steele, 2002).

In this way, students became consumers of a service provided by universities and quality assurance became an integral part of that thinking which had been transferred from the world of business and industry (King, 2004b).

The public service reform movement was launched in the Anglo-American world in the mid 1980s, emphasising economic norms and values linking efficiency and accountability (Minogue, Polidano and Hulme, 1998). The reform requires the public service sector to focus more on “*output and outcomes*” rather than “*input and processes*” (Hughes, 1994).

Since the reform of public management, public expenditure has been constrained and the power relations between governments and universities have been shifted (Taylor, Rizvi, Lingard and Henry, 1997; Yorke, 2000). Markets, customers, outputs, efficiency and accountability have become central to public management (Hughes, 1994) and a consumer mentality assumed (Goedegebuure, Kaiser, Maassen and Weert, 1994; Lawton, 1992).

The effect on the university sector changed the way universities had to operate with difficulties and controversies arising when universities were seen as parallel to production industry (Ellis, 1993a; Newton, 2002). The effect on schools varied from country to country. In some (like Scotland), schools continue to be seen as a public service although the driving force of quality assurance still existed. In other countries (like England), schools were more overtly seen in a competitive market place and this led to the generation of diverse types of secondary schools, working to a wide range of priorities.

## **2.11 Some Conclusions**

This chapter has aimed to offer an overview of the nature of quality assurance and how it came to be introduced into school education. In one sense, it has always been there for schools were to some extent accountable to their communities, to local or national politicians while teachers often took their responsibilities towards the learners with great seriousness.

The literature assumes that quality assurance is an effective tool for improving quality in school education, parallel to production industry. The evidence to support this comes almost entirely from data from examination outcomes but there is little to support the

belief that these are genuine indicators of quality. In simple terms, examinations are measuring instruments with no fixed scale: easier examinations give higher marks.

Thus, quality assurance has been criticized that it cannot, on its own, improve educational quality. Negatively, quality assurance may de-professionalise teachers, reducing academic freedom, institutional diversity, and the achievement of wider goals (which are often not easy to measure).

This chapter focussed on the various definitions of quality assurance. The main objective of this chapter is not only to provide an overview of these concepts but also to examine the diverse issues involved. The literature reviewed in this chapter has demonstrated that the quality assurance concept has developed in the education system from inspection through quality control and quality assurance to total quality management.

A critical feature to emerge is the flexible nature of quality assurance as it can be adapted to specific contexts and cultures and this will be critical in this study on Bahrain education and working of the quality assurance. This is in addition to the holistic nature of quality assurance which consider the educational dimension, the human dimension and the technical dimension of the organization.

Quality assurance, as it has been applied to schools in the secondary sector, has failed to come to terms with the need to define what is meant by quality. Of course, this involves quality in the curriculum and assessment regimes (outwith school control), quality in actual resources and resource levels (also outwith school control) as well as quality in school leadership and school ethos. What goes on in the classroom must be set in that matrix. Inspection and tick-box approaches may very well fail to capture the reality of learner experiences in the same way as quality control and inspection failed in production industry.

It has to be noted that it is never in the interests of any educational institution not to aim at quality. Indeed, the vast majority of those entering teaching in many countries do so out of commitment to their subject and the desire to make that subject alive and real to young learners. It is a problem for those in quality assurance to demonstrate that what they are seeking to do has actually improved quality, seen in terms of the overall experience of young people who then leave school to make a successful and productive contribution to their societies as well as fulfilling their own potential.



## Chapter 3

### Focussing on the Teacher

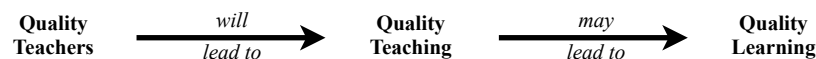
#### 3.1 Introduction

In chapter two, the literature on traditional views of quality assurance was reviewed in a general sense. This chapter sets out to review the literature and research generally on teacher education in schools, and particularly in the quality of teaching and learning, as well as in teacher evaluation.

#### 3.2 Quality of Teachers and Teaching

It is self-evident that the quality of the teacher will be related to the quality of teaching and the quality of learning. Thus, Darling-Hammond (2000) observes that:

*“Like other studies, this research indicates that the effects of well-prepared teachers on student achievement can be stronger than the influences of student background factors, such as poverty, language background, and minority status. And while smaller classes appear to contribute to student learning ... the gains are most likely to be realised ... when they are accompanied by the hiring of well-qualified teachers”. (p. 19–20)*



**Figure 3.1 Quality Links**

It is often assumed that quality learning can be measured by examination outcomes. However, this will rarely be the case for numerous other major factors may come into play. While the teacher quality is important, numerous other factors do have some influence. For example, the perceived relevance of the curriculum, the type of examination and the extent to which learners value learning itself will all be factors. Good and Brophy (1995) refer to enthusiasm, flexibility, perseverance, concern for children as well as subject matter knowledge and academic ability, professional knowledge and experience. Numerous reviews have considered aspects of teacher effectiveness (Darling-Hammond, 2000a; Wilson, Floden, and Ferrini-Mundy, 2001).

In a comprehensive review by Darling-Hammond (2000), she investigated the relationships between student achievement and the various State practices in the United States. She triangulated data from surveys of State policies and case studies of State policy making with distributions of State achievement scores and resources and was able to take into account some student characteristics. She concluded that:

*“The findings of this study, in conjunction with a number of other studies in recent years, suggest that States interested in improving student achievement may be well-advised to attend, at least in part, to the preparation and qualifications of the teachers they hire and retain in the profession. It stands to reason that student learning should be enhanced by the efforts of teachers who are more knowledgeable in their field and are skilful at teaching it to others. Substantial evidence from prior reform efforts indicates that changes in course-taking, curriculum content, testing, or textbooks make little difference if teachers do not know how to diagnose their students’ learning needs...” (p. 19–20).*

### 3.3 Teacher Education

Thinking of primary education, Wijayawardana and Bhattacharya (2004) point out that many teachers do not feel that their teacher education programmes adequately prepare them for certain teaching tasks. This is a worrying comment but not that uncommon.

Darling-Hammond (1997, page 30) looks at what calls “seven extraordinary teacher education programmes” and notes several important features they held in common (summarised in table 3.1).

Common Features of Excellent Teacher Education
Shared clear vision, evident in underpinning all taught courses and school practice
Curriculum that focussed on child and adolescent development
Entire curriculum taught in the context of school practice
Extended experience in schools (at least 30 weeks)
School experience that integrated well with coursework
Clearly articulated and well-defined standards of practice and performance
Standards which are used to guide and evaluate coursework and school practice
Strong relationships and shared beliefs between schools and teacher trainers
Extensive use of case study methods, teacher research, performance assessments, and portfolio evaluation to ensure that learning is applied to real problems of practice

**Table 3.1 Common Features of Excellent Teacher Education**

Looking at the situation in Oman, Donn (2003, p.1) commented that,

*“There have been a number of studies that focus on changes in school curricula and the necessary resonance with activities in Colleges of Education. In these studies it has been found that for change (transformation, even) and the implementation of school curricula to be successful there needs to be change at many levels within the Colleges: at system level; at institutional level; and at programme level. The first refers to the relationship between the Ministries [Education and Higher Education] in charge of teacher education and schooling; the second to the internal organisation of the Colleges; the third to the daily practice of the staff and students within the College”.*

This could easily have been written in the context of Bahrain where a gap exists between taught courses and practice in Bahrain teacher education. It is essential that teachers can apply the knowledge they gain in taught courses in the practical situations they face as beginning teachers. However, traditionally within teacher education, theory and practice have been regarded as separate entities.

A new trend has appeared in most countries aimed at finding ways to redefine teacher education. Looking again at the primary education scene, Wijayawardana and Bhattacharya (2004) suggest that teacher education should have all aspects integrated fully with each other. Sadly, in Bahrain, this level of integration is very difficult to implement at the moment. In Bahrain, there are three elements in teacher preparation courses: the subject matter to be taught, the methodologies to be used in teaching, school practice. The first two are taught completely separately from the third but there is even separation between subject content and teaching methodology.

Thiessen (2000) makes the obvious point that studying about teaching skills, observing and trying out skills under simulated and actual classroom conditions, and comparing and elaborating skills in classrooms are essential elements in teacher education and sees these needing to be connected closely in order to prepare effective teachers. He emphasizes that the third phase should be focussed on encouraging “*self-evaluation*,

*transforming new knowledge into the natural environment, providing varied practice inducing reflection and providing full support for use of the skills in natural settings”* (p. 515-537). Grossman *et al.* (1989), Gess-Newsome (1999) and Grossman (1990) all support this and note the essential need to develop theory-practice links to reach the goals of teacher education

The stated main purpose of the Pre-Service Basic Teacher Education Programme provided by the Ministry of Education in Bahrain is to prepare teachers for teaching. The programme involves the taught course material and the pedagogical courses along with school practice. Much of the time, these are not integrated together in any meaningful way. In addition, despite various education reforms, teacher education has not fully embraced the changing role of the teacher where teachers are no longer seen simply as purveyors of knowledge to be imparted the learners.

In a study looking at primary education in Fiji, Lingam (2004, p. 54-55) pictures the ideal teacher education curriculum as able to produce the teacher who,

- 👤 *“Has a holistic view, who is concerned for the overall physical, mental, cultural and spiritual development of the child.*
- 👤 *Recognize the cultural underpinning in the various disciplines and uses these to advantage.*
- 👤 *Views education as preparation for life, not merely for employment, so that she/he develops each child’s potential to become a worthy member of society.*
- 👤 *Has sufficient flexibility not only to draw on the strengths and inspirations of his/her cultural roots, but who can cope with and educate children of societal and technological changes. (The ability to balance western and traditional cultural values and methodologies would be valuable).*
- 👤 *Has the necessary problem-solving and research skills to be a reflective teacher.*
- 👤 *Sees himself/herself as a positive role model for the children and for the community in which he/she serves.*
- 👤 *Has appropriate learning to learn skills to cope with changes in the environment.*
- 👤 *Has a thorough and up-to-date knowledge of the school curriculum.*
- 👤 *Is able to successfully function in multiple class or very large, single class context.*

- 👤 *Will seek ongoing professional development.*
- 👤 *Will be able to evaluate both learning and teaching.*
- 👤 *Assists in evaluation and revision of the teacher education curriculum.”*

Many of these aspects of the ideal teacher education curriculum are relevant in the context of secondary education in Bahrain.

In the context of education in England, Fullan (2002) suggests that any attempt to produce deep improvements in the education of teachers fails because society does not treat teacher education as a serious endeavour. He suggest that attempts fail in two senses: *“it gives teachers failing grades for not producing better results; at the same time, it does not help improve the conditions that make success possible”*. These are harsh criticism but almost certainly totally valid.

Schon (1983) suggests that the relationship between practice, competence and professional knowledge needs to be turned upside down:

*“We should start not by asking how to make better use of research based knowledge but by asking what we can learn from a careful examination of artistry, that is, the competence by which practitioners actually handle indeterminate zones of practice, however that competence may relate to technical rationality”.*

This moves well beyond the mechanical way teaching is so often portrayed by those outside the classroom. Perhaps the list developed by Darling Hammond (1999) for teacher education in the US reflects a somewhat similar paradigm of thought (see table 3.1).

### 3.4 Pedagogical Content Knowledge

The concept of Pedagogical Content Knowledge conceived by Shulman (1986) embraces the idea that successful teachers have a special understanding of content knowledge and pedagogy, which they draw on in teaching that content:

*“The most useful forms of representation of [topics], the most powerful analogies, illustrations, examples, explanations, and demonstrations - in a word, the ways of representing and formulating the subject that make it comprehensible to others” (Shulman, 1986, p. 9)*

Also "encapsulated" in the idea of Pedagogical Content Knowledge is the notion that successful teachers have a special knowledge about learners which informs their teaching of particular content (Schulman, 1986). Pedagogical content knowledge also includes an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons.

While Shulman's notion of Pedagogical Content Knowledge may seem to resolve the question of what it is that successful teachers know in order to teach in ways that achieve student understanding, the concept itself and its relationship to other fields of teacher knowledge is debated in the literature (Cochran, King, and De Ruiter, 1993; Grossman, 1990; Mulhall, Berry, and Loughran, 2003). Shulman (1987) categorises the Knowledge Base for Teaching as:

- 🏆 *Content Knowledge.*
- 🏆 *General Pedagogical Knowledge, with special reference to those broad principles and strategies of classroom management and organisation that appear to transcend subject matter.*
- 🏆 *Curriculum Knowledge, with particular grasp of the materials and programmes that serve as ‘tools of the trade’ for teachers.*

- 🌟 *Pedagogical Content Knowledge, that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding.*
- 🌟 *Knowledge of Learners and their characteristics.*
- 🌟 *Knowledge of Educational Contexts, ranging from the workings of the group or classroom, the governance and financing of school districts, to the character of communities and cultures.*
- 🌟 *Knowledge of Educational Ends, Purposes and Values, and their philosophical and historical grounds.*

Shulman (1987) developed the construct of Pedagogical Content Knowledge in response to some of the problems of teaching and teacher education. The construct is often not grasped fully in national education documents eg the US National Science Teacher Association (NSTA). However, Shulman (1987) stresses the important issue when he states that the, "*the key to distinguishing the knowledge base of teaching lies at the intersection of content and pedagogy*" (Duggan-Haas, *et al*, 2000, p. 20).

Duggan-Haas *et al.* (2000) go on to argue that teachers of science need to be prepared to help students uncover the embedded texts of scientific ideas. Pedagogical content knowledge provides a useful lens for teachers to begin to help students see the assumptions of science, e.g. teacher can help students see the value of evidence in making a scientific claim. However, this requires more than knowing content and how to teach. It requires an understanding of how to teach the content, namely pedagogical content knowledge.

Duggan-Haas, *et al.* (2000, p. 21) state:

*"Pedagogical content knowledge is a type of knowledge that is unique to teachers, and is based on the manner in which teachers relate their pedagogical knowledge (what they know about teaching) to their subject matter knowledge (what they know about what they teach). It is the integration or the synthesis of teachers' pedagogical knowledge and their subject matter knowledge that comprises pedagogical content knowledge".*

Pedagogical content knowledge is a form of knowledge that makes science teachers teachers rather than scientists (Duggan-Haas, *et al*, 2000). Teachers differ from scientists, not necessarily in the quality or quantity of their subject matter knowledge, but in how that knowledge is organized and used. In other words, an experienced science teacher's knowledge of science is organized from a teaching perspective and is used as a basis for helping students to understand specific concepts. A scientist's knowledge, on the other hand, is organized from a research perspective and is used as a basis for developing new knowledge in the field.

This idea has been documented in biology by Duggan Haas *et al*. (2000) in a comparison of the organization of subject matter knowledge among groups of experienced science teachers, experienced research scientists, novice science teachers, subject area science majors, and pre-service science teachers. Cochran (1997) found that science majors and pre-service teachers both showed similar, loosely organized subject matter knowledge; and that the subject matter knowledge of the novice and experienced teachers and the research scientists was much deeper and more complex. However, according to Cochran (1997), the teachers showed a more fixed structure, hypothesized to result from curriculum constraints.

Cochran (1997) revised Shulman's original model to be more consistent with a constructivist perspective on learning. They described a model of pedagogical content knowledge that results from an integration of four major components, two of which are subject matter knowledge and pedagogical knowledge. The other two other components of teacher knowledge also differentiate teachers from subject matter experts. One component is teachers' knowledge of students' abilities and learning strategies, ages and developmental levels, attitudes, motivations, and prior knowledge of the concepts to be taught. Students' prior knowledge has been especially visible in the last decade due to literally hundreds of studies on student misconceptions in science and mathematics. The

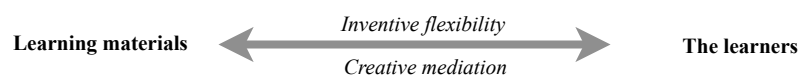


other component of teacher knowledge that contributes to pedagogical content knowledge is teachers' understanding of the social, political, cultural and physical environments in which students are asked to learn. These four components of teachers' knowledge all contribute to the integrated understanding that we call pedagogical content knowledge and this pedagogical content knowledge continues to grow with teaching experience (Cochran 1997).

### 3.5 Creativity in Teaching

In-depth studies on creativity of teachers are rare although its importance is widely accepted in educators nowadays (Randi and Corno, 1997). The classroom is a dynamic, interactive, complex and ever-changing environment. Every moment in teaching, teachers are facing new challenges. They have to solve problems, which they have not been taught directly in training courses or experienced before. Cheng (2001) described two types of inventiveness in teaching: in its simple form, invention involves adapting lessons to particular classrooms and students; and, in its complex form, invention involves devising ways to solve instructional problems.

Cheng (2001) suggested "*inventive flexibility*" as a common type of creativity in teaching. Teachers need to make creative mediation between the given materials and a particular group of learners on a particular occasion (figure 3.2).



**Figure 3.2 Creativity in teaching**

It is this mediation for which some degrees of inventiveness or flexibility become essential. In all their descriptions (Randi and Corno, 1997; Cheng, 2001), teaching was considered as a creative process, demanding the flexibility and adaptability of teachers.

With regards to science teaching, few studies have been reported on the creativity of science teachers. Sussman (2000, p.20) suggested, *"improvisation is a skill that most science teachers quickly master; whether it's searching for inexpensive or free materials for the classroom, substituting everyday materials for expensive lab equipment, or incorporating activities into the curriculum that don't require a lot of materials"*. However, she may be expressing a measure of over-optimism as many school inspectors have observed.

Melear (1993) had developed a course titled *"Creativity and inventiveness in science"*, and *"creative science teaching"* is one of its learning areas. In the final chapter of the book *"Creativity in Primary Science"* (Frost, 1997), its author concluded that *"science teaching provides both the opportunity and the necessity to be creative"* (p.182).

There is no doubt that creativity plays a large role in primary education but it is not so easy to develop such creativity at later stages where the demands of examinations and curriculum coverage curtail teacher freedoms.

### **3.6 The Changing Role of Teachers**

Over the past thirty years or so, there have been some major changes in teaching and learning that have challenged the traditional school system and structure of teacher preparation programmes. Students are no longer regarded as passive learners; they are expected to be active learners and problem solvers. Teachers too are no longer regarded simply *"dispensers of knowledge"*, they are expected to perform a multitude of roles. Wickramasinghe (2004) describes the different roles a teacher must enact, these are: the teacher will be as a communicator, a disciplinarian, a conveyor of information, an evaluator, a classroom manager, a counsellor, a member of many teams and groups, a

decision maker, a role-model, and a surrogate parent. Darling-Hammond, 1997:154 stated:

*“If teachers are to prepare an ever more diverse group of students for much more challenging work .... for framing problems; finding, integrating and synthesizing information; creating new solutions; learning on their own; and working cooperatively ....they will need substantially more knowledge and radically different skills than most now have and most schools of education now develop”.*

Airasian *et al.* (1997) described the role of teacher in constructivist environment while Brooks and Brooks (1993) offer a set of 12 principles which they argue are important in guiding what they a ‘*constructivist teacher*’. However, these simply describe the practices of a good teacher. Indeed, the idea of a ‘*constructivist teacher*’ needs further thought.

Learners will *always* construct their own understandings, irrespective of what the teacher does. That is the natural way of learning. The good teacher will be aware of this and will also be aware that the learners may construct understandings that do not match currently accepted understandings. In that sense, we use the description: ‘*constructivist teacher*’. The good teacher, aware of this, will allow opportunities so that understandings can be constructed more in line with accepted understandings. However constructing meaning is in the heads of learners and is nothing to do with teaching itself. Indeed, the whole notion that constructivism can solve learning problems has been demolished by Kirschner *et al.* (2006). Constructivism is an excellent and valid *description* of what happens. It is predictively very limited (Reid, 2012).

In Bahrain, there have also been major developments in the content and structures of school subjects over the years, school context has been changed, schools are expected additionally to respond to the challenge of preparing individuals for life in the 21st century. These challenges require more innovative ways of learning (Wickramasinghe, 2004, p. 3) these changes reflect and necessitate changes in the roles of teachers. With

the need for schools to adopt more innovative ways of teaching, teachers must become more skilful and professional to remain effective in the future school. The report (UNESCO, 1998, p14, cited Wickramasinghe, 2004, p. 4) states that:

*“A new teacher is at the epicentre of educational transformation. Teachers of the new millennium must be able to develop in their students the competencies and attitudes considered fundamental, such as creativity, receptivity to change and innovation, versatility in knowledge, adaptability to changing situation, discerning capacity, critical attitudes, problem identification and solution”.*

As a statement of intent, this is admirable. How to achieve it is far more of a problem.

Looking at Bahrain, there are two key issues:

- 🌐 Ensuring the adequacy of the supply of trained teachers to meet future demand, not only in aggregate numbers but also in areas of specialization;
- 🌐 Ensuring that the methods employed in training them are adapted to meet the needs of evolving and changing concepts of education and training at this level.

Not only must teacher preparation programmes prepare student teachers to meet contemporary challenges but the way the curriculum is devised and assessed must be compatible with the overall goals. Teachers need to be treated as professionals but they also need the freedom and flexibility of the curriculum and national assessment policies so that they can be creative and forward looking.

In order for educational reform to be effective and lasting, teacher education must undergo a transformation. Pre-service training needs to be improved and life long professional development should be adopted and materialized. Many attempts have been taken to develop such kind of training in many countries. Success has often proved elusive.

In thinking of education developments and reforms, Chuan and Gopinathan (2001) see the need for a re-conceptualisation of the role of teachers. This will mean that future teachers will have to be trained differently and existing ones in the teaching force will need support and on-going development.

There are those who argue for the provision of meaningful learning experiences for teachers (Cohen and Ball, 1999). Finley (2002) talks of the need for collegial relationships among teachers where teachers have opportunities to share ideas, discuss educational issues, and participate in collaborative planning, problem posing, and problem solving. However, it has to be stressed that such initiatives will prove fruitless if the curriculum and assessment systems enforce a retention of traditional memorisation-recall ways of learning (El-Sawaf, 2008).

Finley (2000) has described five characteristics for transformative professional development. Learning opportunities should:

1. *Create a sufficiently high level of cognitive dissonance to disturb the equilibrium between teachers' existing beliefs and practices on the one hand and their experience with subject matter, students' learning, and teaching on the other.*
2. *Provide time, contexts, and support for teachers to think—to work at resolving the dissonance through discussion, reading, writing, and other activities.*
3. *Ensure that the dissonance-creating and dissonance-resolving activities are connected to the teacher's own students and context, or something like them.*
4. *Provide a way for teachers to develop a repertoire for practice that is consistent with the new understanding that teachers are building.*
5. *Provide continuing help in a cycle of surfacing new issues and problems, deriving new understanding from them, translating these new understandings into performance, and recycling.*

These suggestions are helpful but they assume that the teachers will then be free to apply what they have learned with their students. Finley (2000) found that student performance increased when teachers have greater learning opportunities and note the need for consistency between the curriculum specifications and the way it is to be taught.

Lieberman and Miller (2000) identified seven transitions that teachers need to make in '*the new social realities of teaching.*' These can be summarised (table 3.2):

Move from ....	Move to ....
Individualism	Professional community
Teaching at the centre	Learning at the centre
Technical work	Inquiry
Control	Accountability
Managed work	Leadership
Classroom concerns	Whole school concerns
Weak knowledge base	A stronger, broader knowledge base

**Table 3.2 Seven Transitions**

Much of this is good. Perhaps the key transitions relate to ‘*control*’ being replaced by ‘*accountability*’ and ‘*leadership*’ being stressed over ‘*managed work*’. These relate to teachers being trusted as professionals, best equipped to decide what is best for their learners.

It is not possible to reform education systems effectively without taking teachers into greater consideration. Equally, it is not possible for changes to the teachers' role to happen without transforming teacher education (Ordonez and Maclean, 1997). In fact, changes in initial teacher education and in career-long teacher development are an integral part of educational reform and improvement of schools (Beattie, 1997). In Australia, Beattie (1997) stressed that reform of schools and efforts to change them into communities of learning will never happen without the reform of teacher education and acceptance on the part of professionals of the necessity of continual reforming of ideas, concepts and understandings. However, if national curriculum specifications and, even more importantly, national examinations do not reflect fully the desired directions of change, then teachers will be powerless to implement that change.

Many years ago in the US., Goodland (1990) concluded that teacher education was muddling along with neither a clear sense of mission nor coherent programmes while Ishler (1996), Hart and Burr (1996) and Smylie and Kahane (1997) were all critical of US provision although Burnstein *et al.*, (1999) noted some improvements. It is easy to criticise teacher education and the literature abounds with the censure of teacher education programmes. Nonetheless, there is so much criticism that it does suggest not all is well, at least in some countries.

### **3.7 Competency-based Approach for the Bahraini Teacher Education**

Bahrain, like other countries of the world, realises the importance of the teacher to society and, as a result, has conducted many conferences and research projects in order to find logical solutions to the problems which presently prevent teacher's qualifying and professionalizing. This age is witness to great advances of science and technology in all aspects of life, including the foundations of teaching. Bahrain, like other Arab countries, is greatly influenced by this present movement of innovation and change.

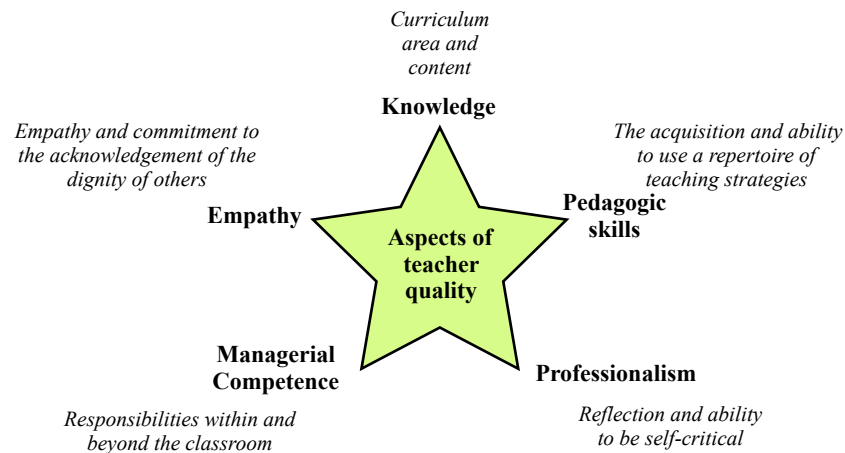
The teaching competency movement began to claim attention in Arabic countries early in the 1980s. Since then, many studies have been carried out concerning the competencies required for teachers. These can be seen to fall into two groups. On the one hand, studies investigating general competencies, which are considered necessary for every teacher, regardless of the subject matter that he/she teaches; and, on the other hand, investigation of specific competencies related to the subject matter taught (AlGattami, 2002). However, there is little evidence that the competency approach has led to improvements.

There are many examples of lists of competencies (eg. SEDL, undated; Education@Davidson, 2012; GTCNI, 2006; Talentlens, undated) and examples of procedures to be followed when facing failure possibilities (eg. National Union of Teachers, undated; GTCS, undated) but no evidence was found of any effectiveness of this approach.

### **3.8 Dimensions of quality of education and teaching**

The quality of education, inevitably, has many dimensions. Indeed, resource provision can make a large difference (Heyneman and White, 1986).

The OECD (1994) suggested that teacher quality encompassed the following five dimensions (as shown in figure 3.3):



**Figure 3.3 Teacher Quality (derived from OECD, 1994)**

While it is recognised that qualifications are not necessarily reliable indicators of the performance of individual teachers, they do indicate teachers' general education levels and their learning for a specific job. Thus, statistics on teacher qualifications may, therefore, act as another proxy indicator of quality (Bray and Lillis 1988).

Anderson (1991) argues that teachers have absolute power over innovation and change even in the most highly centralized systems of education. However, there is clear evidence that this is not true (El-Sawaf, 2007). No matter how committed, curriculum and assessment constraints may make innovation virtually impossible as El-Sawaf (2007) demonstrated.

In order to consider improvements in teacher quality, there is pressing need for indicators of teaching quality and teaching performance (Australian Journal of Education, 2003). These are both inputs; what the outputs might be is not so clear. Both the process and the product need to be considered. Sadly, most countries use evaluation procedures for supervision and management control rather than as tools for learning from experience.



We can still draw the following points ongoing school improvement by qualities of a good teacher as displayed below in the (table 3.3).

Criteria	Evidence	Ways to develop
Adequate knowledge of subject area	Paper qualifications	Continuous Professional Development (CPD), including modelling of best practice
Empathy for learners	Class observation	
Clarity of thought	Interviewing learners, class observation	
Creative in developing learning situations	Class observation	
Clear communication skills	Interviewing learners, class observation	
Sympathetic control, commanding respect	Interviewing learners, class observation	
Clear grasp of the goals for learning	Class observation, Academic achievement	
Enthusiastic and engaging	Interviewing students, class observation	
Practical (use of hands-on activities in the class)	Class observation, Interviewing learners	
Ability to improvise and cater for most of the learners needs	Class observation, Academic achievement	
Current with the new teaching learning trends in their subjects	Class observation	

**Table 3.3 Qualities of a Good Teacher**

### 3.9 The Danielson Model

In a refreshing analysis of quality teaching, Danielson (2007a) suggests four domains of teaching responsibility and develops the key areas within each domain:

1	Planning and Preparation	How the teacher designs instruction.
2	The Classroom Environment	How the teacher sets the stage for all learning.
3	Instruction	How the students engage with learner.
4	Professional Responsibilities.	The characteristics of being a true professional educator.

**Table 3.4 The Danielson Model**

The four domains each is now discussed in turn.

### 3.9.1 Domain 1: Planning and Preparation

In the US, Danielson (2007a) describes how a teacher organizes the content that the students are to learn and how the teacher designs instruction.

From Danielson (2007a), planning and preparation component should be:

- (a) *Demonstrating Knowledge of Content and Pedagogy Component.*
- (b) *Demonstrating Knowledge of Students Component.*
- (c) *Setting Instructional Outcomes Component.*
- (d) *Demonstrating Knowledge of Resources Component.*
- (e) *Designing Coherent Instruction Component.*
- (f) *Designing Student Assessments.*

Teachers are asked to plan their work. They are expected to prepare a written plan for the whole year which may include learning outcomes, behavioural objectives, instructional aids (or the materials they need for the tasks), teaching methods and assessment strategies. They also asked to prepare other written detailed plans for daily lessons. These plans are checked and signed by the head teachers, inspectors and senior teachers from the Ministry of Education. There is a standard form for these plans recommended by the curriculum advisors in the Ministry of Education, but teachers are allowed to design their own planning form. However, they must include all of the previous main elements of the suggested forms in their lesson plans.

Skowron (2001) underscores the importance of careful planning. Good planning sets the stage for good teaching, which in turn fosters optimal learning. Teachers who know how to plan know precisely what they want to accomplish or more exactly, what they want their students to accomplish. Poor planning results in no one, including the teacher, having a clear understanding of what is to be accomplished. Effective instruction starts with an organized instructional plan.

Jackson and Davis (2000) also address the need for teachers to use resources available through collaboration. They discuss how special education teachers and other

colleagues can be excellent resources when planning instruction. However, being able to complete written plans may simply be an indicator of a clear and logical mind, capable of organizing material in sensible ways. For many teachers, this can be done without resorting to written documentation and, indeed, the requirement to document may prove a hindrance.

### **3.9.2 Domain 2: The Classroom Environment.**

The classroom environment competencies should address the teacher's ability to manage the educational environment, and directly manage and assess students' classroom behaviour. As Gilbert and Lignugaris-Kraft (1997, p. 6) state:

*“Classroom management competencies should be divided into four categories. Two categories address the educational environment: (a) arrangement of the physical environment to facilitate student management, and (b) formulation of a standard for student behaviour in the classroom. Two further categories address teachers' management and behavioural assessment: (c) implementation of strategies to increase appropriate behaviour or to reduce inappropriate behaviour, and (d) assessing or measuring the effectiveness of the implemented strategies”.*

Practicing teachers place greater importance on classroom management competencies than do student teachers. Danielson (2007a) establishes a comfortable and respectful classroom environment that cultivates a culture for learning and creates a safe place for risk taking.

- (a) Creating an Environment of Respect and Rapport Component.*
- (b) Establishing a Culture for Learning Component.*
- (c) Managing Classroom Procedures Component.*
- (d) Managing Student Behavior Component.*
- (e) Organizing Physical Space.*

In the development of teachers skills, trainee teachers must master at least the rudiments of classroom management before they can become skilled at instruction.

Whitaker (2004) notes that one of the hallmarks of effective teachers is that they create a positive atmosphere in their classrooms and schools. He goes on to state, “*Effective teachers treat everyone with respect, every day*” (p. 45). Jackson and Davis (2000) recommend that teachers provide students with rich learning environments.

Whitaker (2004) describes how effective teachers manage student behaviour:

*“Great teachers are very clear about their approach to student behavior. They establish clear expectations at the start of the year and follow them consistently as the year progresses”. (pp. 17– 18)*

### 3.9.3 Domain 3: Instruction

There is a need to use different learning resources in teaching as well as implementing a variety of teaching methods and strategies in order to meet different student learning styles. Danielson (2007a) states the components that are at the essential heart of teaching the actual engagement of students in content. It is impossible to overstate the importance of domain 3, which reflects the primary mission of schools: to enhance student learning. The components in Domain three are unified through the vision of students developing.

- (a) *Communicating with Students Component.*
- (b) *Using Questioning and Discussion Techniques Component.*
- (c) *Engaging Students in Learning Component.*
- (d) *Using Assessment in Instruction Component.*
- (e) *Demonstrating Flexibility and Responsiveness.*

Brooks and Brooks (1993) suggest that effective teachers encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other. They assert that complex, thoughtful questions challenge students to look beyond the apparent, to delve into issues deeply and broadly, and to form their own understandings of events and phenomena. Ellett’s (1990) work states that student involvement is needed. In teaching students to think, the teacher deliberately structures

and uses teaching methods and learning tasks that actively involve students in ample opportunities to develop concepts and skills in generating, structuring, transferring, and restructuring knowledge (p. 47).

Skowron (2001) reviews the literature in this area and comes to a similar conclusion: The purpose of engagement is to involve students in developing important concepts, skills, and processes. Engagement provides the condition in which concepts are made meaningful. Using assessment in instruction is also integral to providing superior educational opportunities.

Torp and Sage (1998) provide details on how to construct problem-based learning experiences effectively for students at all grade levels. They stress the importance of helping students make strong connections in an authentic context using a standards-based approach in which students are accountable for their own learning, demonstrating proficiency when assessed.

#### **3.9.4 Domain 4: Professional Responsibilities.**

Professional responsibilities are associated with being a true professional educator and encompasses the roles assumed outside of and in addition to those in the classroom with students. Students rarely observe these activities; parents and the larger community observe them only intermittently. But the activities are critical to preserving and enhancing the profession. Educators exercise some of them immediately upon entering the profession, because they are integral to their work with students.

Danielson (2007a) described the Responsibilities Component:

- (a) Reflecting on Teaching.*
- (a) Maintaining Accurate Records.*
- (a) Communicating with Families.*

- (a) Participating in a Professional Community.*
- (a) Growing and Developing Professionally.*
- (a) Showing Professionalism.*

Tucker and Stronge (2005) studied successful teaching and found that qualities of effective teachers include collegiality, collaboration, a strong belief in efficacy, and contributions to the school and community.

Gabriel (2005) promotes the nurturing of teacher leadership and efficacy in today's schools. Thinking of the US, he notes that, for nearly a century, schools have functioned in the autocratic style of the line-staff model: principals are managers and teachers are their employees, often voiceless and powerless to influence their superiors' quest to improve student achievement. Teachers who are committed to growing and developing professionally concern themselves with enhancing their content knowledge and pedagogical skills, as well as productively contributing to the profession. However, it has to be noted that this model has long since been discarded in many European countries.

Although Fullan (2001) places value on the growth efforts of individual teachers and describes the importance of programme coherence as a means to combat fragmentation of multiple innovations, his research on progress also emphasizes the role of the entire group in a school. Thus, professional development or training of individuals is not sufficient. For this reason schools must focus on creating school wide professional learning communities.

Wormeli (2003) discusses the importance of keeping accurate classroom records, including those documenting grades, missed assignments, work habits, incidents of tardiness, and absences. He suggests that teachers give students the responsibility for some of the record keeping in the classroom. Exceptional teachers also display professionalism by serving as advocates for children .

Jackson and Davis (2000) underscore the importance of students having an advocate and claim that, when students make a lasting connection with at least one caring adult in school, academic and personal outcomes improve. The link between parent involvement in schools and student learning is well established. Jones (1992) and Cruickshank (1990) compiled research suggesting that, in general, student learning is enhanced when teachers work at parent involvement. Powell *et al.* (1991) provide a review of research on parent involvement and its effect on student learning. In this set of readings, they establish that parent involvement is intimately associated with academic achievement and that there are a variety of ways for teachers to establish and enhance such involvement. Jackson and Davis (2000) have compiled the results of extensive research on parent involvement to improve student learning. They also emphatically conclude that parents' participation in the life of the school and in their children's schoolwork has a positive impact on student outcomes.

Bucknam, as cited in Marzano (2003), states that schools that involve parents and community in their day-to-day operations have lower absenteeism, truancy, and dropout rates. Research in favour of maintaining parental connections with the school is so overwhelming that the national Parent Teacher Association (PTA) in US developed standards for parent/family involvement programs (Chadwick, 2004). Therefore, it is essential for teachers to regularly communicate with parents and engage them in the total school experience.

However, there may be a simple explanation underpinning the above research evidence. It may be that evidence of contact with parents may merely reflects parents who are interested in education and willing to be contacted. Such parents are far more likely to support the learning of their children.

### 3.10 The Concept of Evaluation

The entire enterprise of quality assurance involves, in some way, the concept of evaluation. The problem is that it is not always clear what is being evaluated. The essential point is that the learner is at the focus of all education. Therefore, any evaluation must look at the learner to see if what the learner has gained is what was intended and is the best it could be.

This raises a fundamental problem in that evaluating a learner is too easily reduced to assessment of the learner's performance, usually in examinations. The focus of evaluation should be directed at the whole learning provision but it is then too easy to lose sight of the learner. Indeed, there is a danger of considering only the teacher, thus neglecting all the important facets of education that are outwith teacher control.

This section seeks to draw together the literature comments on some of these issues. The field of educational evaluation is a burgeoning one and there is considerable confusion as to what it means and how it can be. Wolf (1990, p.8) mentioned two reasons for this confusion.

*“First it stems partly from the fact that many of the techniques and procedures used in evaluating educational enterprises are rather technical, and educators are often not knowledgeable about such matters. Second a more basic reason for the confusion, however, is that different authors have different notions of what educational evaluation is or should be”.*

Norris (1993, p.16-7) states that:

*“Until Ralph Tyler's work in the 1930s, evaluation was virtually synonymous with measurement and testing ... Many would regard Tyler as the founder of educational evaluation, indeed the invention of the term has been ascribed to him”.* He argues that *“Tyler commented that the term ‘evaluation’ was used rather than ‘measurement’, ‘test’ or ‘examination’ because evaluation implied ‘a process by which the values of an enterprise are ascertained’”*



According to Norris (1993, p. 18):

*Tyler's work shifted evaluation away from a focus on individual abilities and qualities towards a focus on curriculum design. He saw evaluation not as technology for discriminating between individuals, but rather as a means of appraising the degree to which curriculum intentions were realised in practice.*

Regarding the difference in what evaluation is about, there are two groups of definitions. One set of writers simply define evaluation as an act of providing useful information for further educational actions such as improving educational practices, materials, decision making. Cronbach (1963), for example, defines evaluation as:

*"The collection and use of information to make decisions about educational programmes"*

Worthen and Sanders (1987) point out that what is missing from this definition is the act of making a judgement about the value of the evaluation object. There are, however, other writers who assert the importance of making judgements based on the values of the evaluation audience (s). Stake (1967, p.525) represents this position:

*"both description and judgement are essential-in fact, they are the two basic acts of evaluation. Any individual evaluator may attempt to refrain from judging or from collecting the judgements of others. Any individual evaluator may seek only to bring to light the worth of the programme. But their evaluations are incomplete. To be fully understood, the educational programme must be fully judged"*

However, there are also other definitions for evaluation. Johnstone (2001, p. 2) defines evaluation as, *"the means by which a course or a curriculum change can be monitored to see if, in fact, it is what it claims to be and if it achieves, in students, the intended outcomes."*

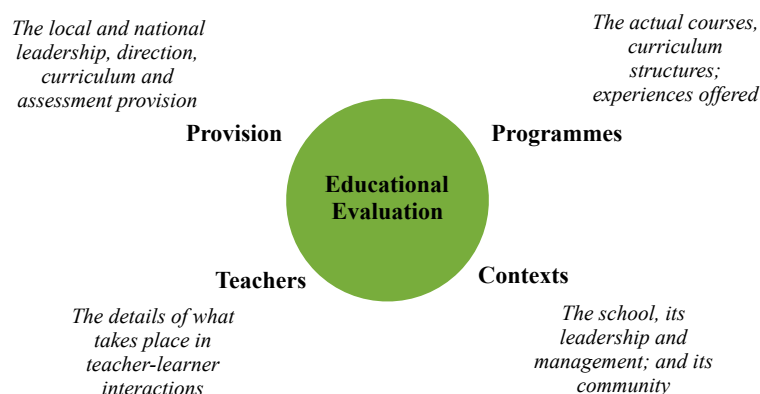
Evaluation has been defined by the Joint Committee on Standards for Educational Evaluation (1981) as the, *"Systematic investigation of the worth or merit of a student's performance in relation to a set of learner expectations or standards of performance"*.

Scriven (1991, p. 139) states that:

*“It is the most powerful and versatile of the 'transdisciplines', tools disciplines such as logic, design, and statistics, that apply across broad ranges of the human investigative and creative effort .... the evaluation process normally involves some identification of relevant standards of merit, worth or value; some investigation of the performance of the evaluands on these standards; and some integration or synthesis of the results to achieve an overall evaluation ...”*

Evaluation can be regarded as a formal or disciplined approach to examine the value of a programme based not only on its outcomes but also on its context, inputs, processes and procedures, and products (Worthen and Sanders, 1987). It can be seen that most definitions agree that evaluation is a *systematic* endeavour and use the deliberately ambiguous term 'object', which could refer to a programme, policy, technology, person, need, activity, and so on. The other definitions emphasize acquiring and assessing information rather than assessing worth or merit because all evaluation work involves collecting and sifting through data, making judgements about the validity of the information and of inferences we derive from it, whether or not an assessment of worth or merit results (Trochim, 2002).

Educational evaluation can fulfill the following goals (figure 3.4)



**Figure 3.4 Education Evaluation**

Each of these is now considered in turn.

### 3.10.1 Programme Evaluation

The concept of programme evaluation can include a wide variety of methods to evaluate different aspects of programmes. Much has been written but very often it relates to programmes in general and not just school learning.

Programme evaluation can be defined as follows:

*A process of making reasonable judgements about programme effort, effectiveness, efficiency and adequacy, based on systematic data collection and analysis, designed for use in programme management, external accountability, and future planning, focuses especially on accessibility, acceptability, awareness, availability, comprehensiveness, continuity, integration, and cost of services (Attkisson et al, 1978: p. 24).*

Rossi *et al.* (2004) define programme evaluation in terms of social research methods:

*“The use of social research methods to systematically investigate the effectiveness of social intervention programmes in ways that are adapted to their political and organisational environments and are designed to inform social action in ways that improve social conditions” (Rossi et al, 2004, p.28).*

Ross (1989, p.18) also speaks of the systematic application of social research procedures for assessing the conceptualization, design, implementation, and utility of social intervention programmes,

Weiss (1972) is more precise when he speaks of the purpose of evaluation research being to measure the effects of a programme against the goals it sets out to accomplish as a means of contributing to subsequent decision making about the programme and improving future programming. Patton (1986) refers to the systematic collection of information about the activities, characteristics, and outcomes of programme for use by specific people to reduce uncertainties, improve effectiveness, and make decisions with regard to what those programmes are doing and effecting.

Focussing tightly on education, Johnstone (2001) states: “*The factors or dimensions we use for the evaluation can span a wide range including:*

- 🏆 *Improved student learning (measured in new or conventional ways)*
- 🏆 *Students’ attitudes to a course in terms of ease or difficulty, pleasantness or unpleasantness work load, teacher performance, methods of presentation and so on.*
- 🏆 *Ease of organisation.*
- 🏆 *Staff commitment.*
- 🏆 *Economy of resources and time.*
- 🏆 *Type of examination and ongoing assessment.*
- 🏆 *Employers’ reactions.*
- 🏆 *Standards acceptable nationally or internationally.”*

Thus, programme evaluation is a process of carefully collecting information about the programme or some aspect of it in order to make decisions about it. Thus, programme evaluation can include a variety of different types of evaluation used for different purposes, such as for needs assessments, accreditation, cost/benefit analysis, effectiveness, efficiency, formative evaluation, summative evaluation, goal-based, process, outcomes, etc. The type of evaluation undertaken to evaluate the programme depends on what the evaluator wants to learn about the programme.

### 3.10.2 Teacher Evaluation

Another feature of Danielson work is the way she challenges the idea of teachers being assessed in some way by outsiders infrequently visiting the teaching situation. She notes how this is so artificial and unrealistic. Indeed, as soon as an outsider enters the teaching room, the situation in the room has changed and it is totally unrealistic to try to make any kind of judgement based on one visit. One of her major contributions is the way she sees trained evaluators, *who are still teachers*, being a major part of the whole process. She seeks to shift the emphasis away from what is traditionally called, ‘*inspection*’ to what she calls ‘*collaborative reflection*’ (Danielson Group, undated).

Her own research shows that this works well. Indeed, the principles have been adopted by Chile where it has operated since 2004, apparently with considerable success (Avalos and Assael, 2006; Higuera, 2009). Overall, it is a multiple approach method of evaluation, with considerable on-going training: all teachers are involved in an affirmative way both as evaluators and those being evaluated.

Danielson (2001) pointed out that, *“As teacher quality takes center stage in education reform, evaluation strategies are helping teachers at all career stages grow professionally”* (p 12).

### **3.10.3 Purposes of Teacher Evaluation.**

Danielson (2008) states that teacher evaluation has two essential purposes: ensuring teacher quality and promoting teacher learning. Although both are critical, they are sometimes seen as being in conflict with one another.

As noted, a principal purpose of teacher evaluation is to ensure teacher quality. Schools are, after all, organizations that accept money from government agencies if they are public schools and directly from parents if they are independent schools. Those investing in schools have a right to expect that their funds will be well used and that the most important aspect of schools the teaching is of high quality. This demand is uncompromising, and leaders in every school and school district must be able to assure clients that the quality of teaching is high (Danielson 2008).

Danielson (2008) noted a system of teacher evaluation seeks to promote professional learning, to aid in the ongoing improvement of teaching. In fact, one could argue that part of the professional responsibility of every teacher is to always seek ways to improve. The teacher evaluation system is another mechanism for contributing to the improvement of teaching.

### 3.10.4 Teacher Evaluation process

In the context of the US, Danielson (2008) suggested that the evaluation process envisioned is organized as follows:

- (1) *Nontenured Teachers, it is essential for evaluators to assemble evidence of all aspects of the teacher's performance,. On the other hand, it is important to bear in mind that teachers new to the profession may be overwhelmed by the demands of their jobs, so it is unwise to ask them to do more for the evaluation process than is reasonable.*
- (2) *Tenured teachers and their administrators should begin the evaluation cycle with a general discussion about the teacher's overall practice. This practice has the benefit of enabling teachers to hear one another's answers to the questions and to learn from those responses, the comprehensive evaluation is affirmation of the quality of teaching. The practice of all teachers is thereby strengthened.*
- (3) *Evaluation System for Experienced Teachers,*
  - \* *Teaching Interview For conversations with experienced teachers about their practice.*
  - \* *Teacher Lesson Reflection For the teacher's self-assessment*
  - \* *Informal Classroom Observations For periodic brief observations of teaching.*
  - \* *Formal Classroom Observation For formal observations, including planning and reflection conferences.*

### 3.10.5 The Evaluation Decision

Danielson (2008) described the evaluation decision inevitably consists of a number of smaller judgments regarding performance in the classroom, completion of non classroom responsibilities (such as communicating with families), and participation in a professional community. In making an evaluation decision, administrators must coordinate information from a number of sources to arrive at a final judgment.

### **3.10.6 Framework for Teacher Evaluation.**

Danielson (2008) noted the most frequent use of the framework for teaching is for the evaluation of teacher performance. Both academic and practicing educators agree that among the factors within the school that contribute to student learning, the quality of teaching is the single most important. Thus, of all the important tasks assigned to school leaders, ensuring and promoting high-quality teaching should be paramount; everything else fades in comparison. Danielson seems to be arguing that we need a clear picture of what is meant by good teaching. Using that picture, appraisal can be based on relating the observed teaching with this set of standards. This allows a higher level of profession judgement and, indeed, allows teachers to develop self-appraisal skills

### **3.10.7 The Quality Assurance link to evaluation system**

Danielson(2001) described the requirements for quality assurance link directly to the structure for the elements of an evaluation system (the “what,” the “how,” and “trained evaluators”).

#### **(1) The “What”**

The standards of performance must be clear and unambiguous, and both publicly known and publicly derived. To ensure teaching quality, schools must base the evaluative criteria on recent research on teaching and learning. This ensures the validity of the criteria. In addition, the criteria should include all the important aspects of teaching and not be limited to only a part of what teachers do. For example, an evaluation system that defines teaching solely in terms of what teachers do in their classroom interactions with students misses all the important aspects of the teaching role that occur outside that venue. And yet, who could argue that communication with families is not an important part of a teacher’s role, and should not therefore be part of an evaluation system?

## **2 The “How”**

To ensure a valid evaluation system, when schools identify certain criteria as contributing to good practice, they should ensure that teachers will be able to demonstrate the criteria. If, for example, communicating with families is one of the evaluative criteria, how will teachers demonstrate their skill? Because this skill is not visible in a classroom observation, schools must devise other procedures to evaluate it. Evaluation processes must allow for evaluators to make reasonable judgments regarding the quality of teaching; and schools and districts must include procedures to offer intensive assistance.

## **3 Trained Evaluators**

The training of evaluators has several important dimensions:

- First, evaluators must be able to recognize examples of the evaluative criteria in action.
- Second, evaluators must interpret the evidence for some aspect of teaching against the evaluative criteria.
- Third, the evaluator must make a judgment about the teacher’s performance, linking the interpretations to the descriptions of levels of performance. In addition, evaluators must be able to hold reflective conversations and provide constructive feedback.

In all of this is an implicit requirement that the evaluator must have credibility in the eyes of the teacher. This is where the Danielson idea that every teacher is both evaluated *and* is an evaluator is so important. Only those who have extensive up-to-date experience in the classroom will carry the necessary credibility and empathy for the task.



### **3.10.8 Teacher Evaluation with Classroom Observation**

Danielson (2001) pointed out that, in many schools and districts in the US, teacher evaluation is synonymous with classroom observation. Indeed, a classroom observation is the best, and the only, setting in which to witness essential aspects of teaching, for example, the interaction between teacher and students and among students. An astute observer can note how the teacher structures the physical environment, how the teacher engages students in learning, how (s)he establishes and maintains standards of conduct.

Nonetheless, there is a danger. As soon as someone else enters the classroom, the dynamics of the classroom are altered. Here again, the idea of teachers being themselves evaluators is so important. The learners soon become accustomed to other teachers being present on numerous occasions and the modification of the classroom reality is thus reduced.

### **3.10.9 Teacher Evaluation with Planning Documents**

Danielson (2001) noted planning is an important skill in its own right, distinct from a teacher's ability to conduct a successful instructional experience for students. Planning requires thoughtful consideration of what students should learn; the nature of the subject; the background, interests, and skills of the learners; and how to engage students in a meaningful way with the content. Skilled planning requires a thorough knowledge of the subject, but such knowledge is insufficient. Teachers also need knowledge of content specific pedagogy how to engage students meaningfully and in increasingly complex ways with the content. For instance, a teacher may note that the appropriate ways to sequence activities in developing a topic with students may not be the same as the logical progression of the same topic.

Some aspects of a teacher's performance do not lend themselves to evidence provided by classroom observation, planning documents. If the evaluative criteria include other aspects of professionalism, these will require other forms of evidence altogether. How does a teacher demonstrate skill in communicating with families, for example, or in contributing to the school and district?

In all of this, there is a danger of quality assurance involving excessive documentation. Care, therefore, needs to be taken to ensure that the normal procedures of documentation, which are useful in themselves, are used and that requirements for extra documentation are not imposed.

### 3.10.10 Teacher Evaluation with Parent and Community Communications

Danielson (2001) described class newsletters, curriculum outlines for back-to-school night, student progress reports, logs of parent contacts, notes from parent conferences, and information regarding a planned school excursion are all examples of evidence of a teacher's skill in communicating with families. Teachers might collect these items and present them as part of a professional portfolio for evaluation.

Table 3.5 is an example of a student survey from the work of Danielson.

Statement	<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Agree</i>	<i>Strongly Agree</i>
I understand what I am supposed to do in class and for homework.				
I understand the rules in this class.				
If I need help, I feel comfortable asking for assistance.				
Students in this class usually pay attention to the teacher and to one another.				
All students are treated fairly in this class.				
This class is interesting because we don't do the same things every day				
Students know that they can't get away with things in this class.				
This teacher cares about whether I learn the material.				

**Table 3.5 Student Survey (Middle or High School Students)  
Derived from Danielson (2001)**

Table 3.6 shows a sample parent survey. Surveys can offer highly valuable insights into a teacher's performance, and they can provide feedback to teachers that is unavailable from any other source. Because they are based on perceptions, however, evaluators should not consider parent and student surveys as entirely reliable sources of evidence. At their best, they can be used for formative feedback and to supplement other indicators of teacher performance.

<b>Statement</b>	<i>Strongly Disagree</i>	<i>Disagree</i>	<i>Agree</i>	<i>Strongly Agree</i>
This teacher treats my child fairly and with respect.				
My child has the skills to complete his or her homework.				
This teacher keeps me informed of my child's progress in school.				
My child appears to know what is expected by this teacher.				
This teacher uses a fair grading system.				

**Table 3.6 Parent Survey  
Derived from Danielson (2001)**

Table 3.7 (overleaf) identifies the principal sources of evidence for each of the components of Danielson's (1996) *Enhancing Professional Practice: A Framework for Teaching*. If evaluators use other criteria, they would need to adjust the chart accordingly.

Educators may use various sources of evidence to document the different aspects of performance defined in the established definition of exemplary practice. And although all these sources of evidence serve important evaluation functions, some of them, in addition, engage teachers in valuable professional learning. When evaluation systems allow teachers to choose between different sources, teachers should select those that have the greatest potential for professional learning.

Component of the Framework	Sample Sources of Information
<b>Domain 1: Planning and Preparation</b> 1a: Demonstrating Knowledge of Content and Pedagogy 1b: Demonstrating Knowledge of Students 1c: Selecting Instructional Goals 1d: Demonstrating Knowledge of Resources 1e: Designing Coherent Instruction 1f: Assessing Student Learning	Classroom observation, sample unit plan, sample lesson plan, interview, log Interviews, sample lesson plan Sample unit plan, sample lesson plan, teaching artifact Sample unit plan, sample lesson plan Sample unit plan, sample lesson plan, teaching artifact Sample unit plan, sample lesson plan, teaching artifact
<b>Domain 2: The Classroom Environment</b> 2a: Creating an Environment of Respect and Rapport 2b: Establishing a Culture for Learning 2c: Managing Classroom Procedures 2d: Managing Student Behavior 2e: Organizing Physical Space	Classroom observation; student surveys; parent surveys Classroom observation, teaching artifact, samples of student work; student surveys; parent surveys Classroom observation, interview Classroom observation, interview, records of students sent to the office Classroom observation
<b>Domain 3: Instruction</b> 3a: Communicating Clearly and Accurately 3b: Using Questioning and Discussion Techniques 3c: Engaging Students in Learning 3d: Providing Feedback to Students 3e: Demonstrating Flexibility and Responsiveness	Classroom observation Classroom observation Classroom observation, teaching artifact, samples of student work Classroom observation, samples of student work Classroom observation
<b>Domain 4: Professional Responsibilities</b> 4a: Reflecting on Teaching 4b: Maintaining Accurate Records 4c: Communicating with Families 4d: Contributing to the School and District 4e: Growing and Developing Professionally 4f: Showing Professionalism	Interview, reflection form Attendance records, field trip records Phone logs, letters to parents, back-to-school night, handouts, parent survey, phone calls from parents Logs of professional activities; copies of documents to which teacher has contributed, with explanation of role Logs of professional goals and improved practice; copies of conference programs attended or at which presented Interview, feedback from colleagues

**Table 3.7 Sources of Information**  
**(Derived from Danielson, 2001)**

### 3.11 Self evaluation

School self-evaluation have become a common phenomenon in a large number of educational systems. Schools themselves have developed tools and methodologies that enable schools to evaluate their own functioning. Although many welcome these school self-evaluation, some question their quality (Nevo, 2001; Van Petegem *et al.*, 2005a).

Van Petegem (1998: 104) defines school self-evaluation as *'the process, generally initiated by the school itself, and involving well-chosen participants, who systematically describe and judge the functioning of the school in order to take decisions relating to general school development.'* This definition furnishes us with certain criteria which can be used to describe assess the quality of school self-evaluation.

Three quality indicators relating to the:

- (1) Conduct of the school self-evaluation;
- (2) Results of school self-evaluation;
- (3) Feedback of results to the stakeholders.

(Love, 1991; McBeath, 1999; McBeath *et al.*, 2000; Van Petegem, 2001).

### 3.11.1 The Schools in the Context of self-evaluation

When looking at a school's performance in the context of self-evaluation, eight aspects seem critical in the view of a number of authors (table 3.8):

1	The effectiveness of communication strategies.	McBeath, 1999
2	The personal and professional support extended to members of the school team.	Sammons <i>et al.</i> , 1995
3	The participation of stakeholders in decision-making processes (shared leadership)	Mortimore <i>et al.</i> , 1988
4	The extent to which the school attains shared objectives and enjoys a shared vision.	Potter <i>et al.</i> , 2002
5	The extent of the school's response towards expectations and demands from its environment.	Griffith, 2003
6	The extent to which the school is capable of implementing innovations.	Geijsel, 2001
7	The extent to which actions in a particular school policy domain are informed by, and in line with, activities in other policy domains.	Wikeley <i>et al.</i> , 2002
8	The school's capacity for reflection	Levine and Lezotte, 1990

**Table 3.8 Aspects of self-evaluation**

These aspects can be applied very appropriately to different kinds of activities in schools. For example, this applies both to the implementation of quality control in general, but also to the conduct of school self-evaluations, which means that these eight aspects in schools can be proposed as a framework for investigating the quality of school self-evaluation processes.

### **3.11.2 Personal and Professional Support**

Heads and teachers cannot be expected to engage in successful school self-evaluations unless they have the necessary capacities to do so (Onderwijsraad, 2001). Personal support means paying attention to the personal experiences and personal development of participants during the self-evaluation activities in schools (Little, 1990). That participants feel that their colleagues are working together as a team is a factor in personal support, which implies that teamwork is seen as something positive and not as a threat to the individual's own autonomy. Successful school self-evaluations rely on cooperation, support, trust, openness and involvement (Hargreaves and Fullan, 1992). Among the indicators of personal and professional support during school self-evaluations are the extent to which participants work as a team and achieve synergy; and how sensitive schools are to the individual needs of teachers. Other relevant issues are whether schools are successful in building a climate of trust between heads and teachers and whether they can convince all the participants that there are no ulterior motives behind the self-evaluation.

The idea of self-evaluation fits neatly into the way Danielson sees every teacher as evaluated and evaluator. Everyone is trained. Everyone is affirmed. Trust and professional integrity are encouraged.

### **3.11.3 Shared Leadership**

While head teachers clearly have a central role to play in the management of school self-evaluations, leadership during the process is not a matter for the head teacher alone (Smith and Piele, 1997; Harris, 2004). Effective leaders are aware of the importance of investing in other people in order to get the best results from self-evaluation activities (Harris, 2002). With this in mind, there are two distinguishable components to

leadership during school self- evaluations: leadership exercised by the head teacher and the participation of other stakeholders in decision-making processes. This does not mean, however, that all the teachers and all the parents need to be involved at all times. It simply means that they should be involved where necessary. Hoy and Miskel (2001: 342) stress two key factors in this regard: the expertise of subordinates and their personal stake in the self-evaluation. As such, potential indicators of shared leadership during school self-evaluations are the extent to which schools involve stakeholders in the self-evaluation processes and the extent to which available expertise is tapped and used as a criterion for the sharing of responsibilities.

#### **3.11.4 Shared Vision**

School self-evaluations have to be conducted with a clear objective in mind (Van Petegem *et al.*, 2005a), which means that a clear answer has to be given to the questions: ‘*Who is the initiator?*’ and ‘*Why are we carrying out this school self-evaluation?*’ A feature of high-quality school self-evaluations is a continuous monitoring of the relationship between self-evaluation activities and the objectives proposed (Senge, 2001).

#### **3.11.5 Teacher Self evaluation**

Danielson (1996) pointed out that teachers are highly perceptive of their own skills in teaching, and are, or can become, extremely accurate in their perceptions. Further, the act of self evaluation requires reflection, an activity documented through research to yield professional learning and growth. Self evaluation may be incorporated into either the formal evaluation process, or a process for self directed professional growth, or both. As a source of information, self evaluation can add much to the dialogue regarding the quality of teaching. When a district’s system for teacher evaluation includes

evaluative criteria with clear descriptions of levels of performance, teachers can examine their teaching against those descriptions and determine their relative strengths and weaknesses. The specificity provided in such a system is an encouragement for teachers to examine their practice, and to consider what evidence they might produce to substantiate their self evaluation.

### 3.12 Chile teacher quality

Cox (2004) pointed out that Chile's educational system has undergone major changes, focussed in teaching practices: teachers and students working in new ways which are coherent with the definitions of a new curricula implemented in the 90s. There are aspects of teaching and the work of students which have evolved towards a more active and richer work in learning.

Cox (2004) described three aspects of teachers' work, extra-curricular activities, management of student groups, teaching , described as follows:

#### *Teachers' relationships with peers and extra-curricular activities:*


The prevailing practices among teachers, along with the ideas and values behind them, have evolved towards a more professional and pro-active stance regarding their institution and own activities; teamwork as crucial to professional work is appreciated not only in discourse but practically. Two major facts related to these tendencies are, the recent acceptance by the teachers' union of external evaluation of teaching, and the experience by the immense majority of schools of designing and implementing educational improvement projects.

#### *Social relationships and work with students.*

The teaching practices have moved towards favouring a closer relationship with students and what they can bring into the teaching learning process, which is



conducive to including more of their life elements and contexts within formal teaching experiences. Students more actively now than they did in the past and group work has become a typical feature of Chile's classrooms. (Carnoy, Gove, Marshall, 2003)



 *Teaching:* According to a Ministry of Education in Chile's report to OECD (2004):

*“In this area, the heart of the teachers' role, teaching contents, skills, values, and achieving learning, the evidence suggests qualities typical of a “transitional” nature. These typically combine a better relationship with students and their lives, improving the teaching relationship and making teachers more active, but with a diverse educational purpose.”*

### 3.13 Quality in Scotland

Teacher education in Scotland has a very long history. The Scottish Teacher Scheme was designed to recognise and reward teachers who attained high standards of practice. The scheme emerged in 2001 as part of the agreement, *‘A teaching profession for the 21st century’*, between the Scottish Executive, local employing authorities and teacher organisations (Scottish Executive Education Department, 2001). The teacher scheme is a carefully developed example of a *‘standards based professional learning system’* leading to professional certification (Ingvarson, 1998; Ingvarson and Kleinhenz, 2006b).

Ingvarson (2009) described the main components of such a system:

-  Standards that describe what accomplished teachers know and do, providing, thereby, long-term direction for teachers' professional development.
-  A new infrastructure for professional learning that is responsive to teachers' demands for activities that help them meet the standards.

- 🏆 Valid, reliable and fair assessment procedures for providing professional certification to teachers who meet the standards.
- 🏆 Substantial financial recognition from school authorities for teachers who gain professional certification.

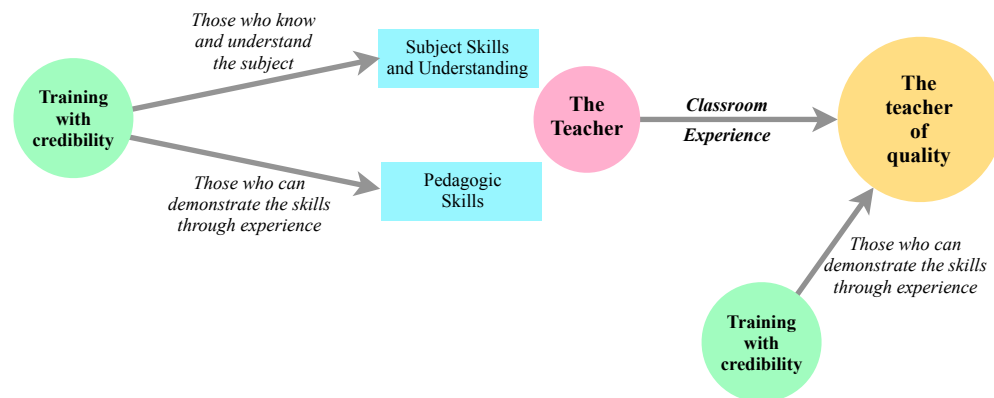
Ingvarson (2009) explained the Scottish Teacher Scheme represents one of the most concerted policy efforts internationally to promote teacher quality. It aims to promote standards-based professional learning and to reward teachers who attain high standards. It provides a substantial salary increase to teachers who attain those standards. This incentive, and the status afforded to the teacher concept, has the capacity to ensure that most teachers will engage in an effective, long term programmes of professional learning to meet the standards. This incentive will be strengthened if teacher status becomes a requirement for teachers to be eligible for promotion to school leadership positions.

### **3.14 Some Conclusions**

This chapter reviews the literature on school teacher education. It emphasises the four domains of teaching responsibility advanced by Danielson including the classroom environment, planning and preparation, instruction and professional responsibility. The chapter also highlighted the literature on the teacher evaluation and the self-evaluation programmes. It also focusses on qualities of education and qualities of a good teacher.

There are two powerful elements in developing quality teachers. One relates to the provision of appropriate training and support. In this, the credibility of those offering training and support is critical and the way it is offered must be tied tightly to the realities of the classroom. The other comes by experience. In an ideal world, each supports the other and the teacher enters a positive spiral of enhanced quality.

A way of looking at this might be as in figure 3.5.



**Figure 3.5 The growth of enhanced teacher quality**

In reviewing the literature, the insights from Danielson stand out. She has grasped with clarity the limitations, and indeed potential damage, of occasional visitors to the classroom passing judgement on teacher quality.

As soon as an outsider enters the teaching situation, the situation is altered and may no longer represent reality. In addition, it is inevitable that those who are currently practicing teachers will start to lose touch with the realities of school life. Indeed, in Bahrain, many who inspect for quality have no teaching experience at all. This raises issues of credibility. In that context, the idea proposed by Danielson of every teacher being both an evaluator and being evaluated takes thinking forward considerably.

## Chapter 4

### Focussing on the Learner

#### 4.1 Introduction

This chapter deals with the learners and how to ensure they are getting the highest quality education possible. However, it is impossible to speak of the learners without involving the learning strategies used by teachers. Models of learning development will be reviewed and their implications discussed. Early in the twentieth century, learning was very much conceived in terms of knowledge acquisition and memorization, and research was very much influenced by behaviourist paradigms of thought. Cognitive approaches started to develop mid-century with the work, initially of Piaget, followed by researchers like Bruner and Ausubel.

Underpinning this chapter is the assumption that quality education must involve teaching (curriculum, pedagogy and assessment) which is in line with the way learning occurs most effectively. In looking at the research evidence on learning, this chapter seeks to identify key features which will make effective learning possible and thus contribute to a quality experience for the learners.

#### 4.2 Piaget's model of cognitive development

It was the development of intellectual structures and knowledge development that was the main contribution of the psychologist Piaget's research (Piaget, 1961; Rottman, 1977). Piaget saw the child learner as an organism developing in an environment, adapting to it and imbibing/assimilating the necessities for growth. All this results in altered behaviour: described as accommodation. Cognition involved what Piaget called schemata (Wadsworth, 1989). Such schemata are continuously formed in interacting

with new and various circumstances and environments and gradually they are internalized, constructing a cognitive repertoire. Schemata can be thought of as ways of thought or systems of thinking or organising information.

Hyde (1970) adds that, as the child grows, he/she utilises this manner of understanding, developing schemata relating to oral interactions and symbols that are of an abstract nature. This is the way that child development is perceived as a continuous ability in dealing with newly accommodated and assimilated circumstances. It is here that Piaget's model resembles constructivism. Indeed, it could be argued that constructivism follows from Piaget's work in the sense that Piaget saw the child seeking to understand experience and, in so doing, constructing their own understandings. He proposes a set of successive stages where one leads on to the next, leading to the development of the concept of cognition (Flavell, 1963). Piaget's (1963) cognitive development model (1963) materialised into a four stage development (see table 4.1). The first was called the sensori-motor stage. This was followed by the pre-operational stage, then the concrete operations stage and the fourth was the formal operations stage.

<b>Stages of Intellectual Development</b>	<b>Description</b>
Sensorimotor (birth to 2 years)	Differentiates self from objects. Recognises self as agent of action and begins to act intentionally. Achieves object permanence, realising that things exist even when no longer present to the senses.
Pre-operational (2-7 years)	Learns to use language and to represent objects by images and words. Thinking is still egocentric with difficulty in seeing the viewpoint of others. Classifies objects by a single feature e.g. colour or height.
Concrete operational (7-11 years)	Can think logically about objects and events. Achieves conservation of number (age 6), mass (age 7) and weight (age 9). Can classify object according to several features and can order them in series along a single dimension.
Formal operational (11 years onwards)	Can think logically about abstract propositions. Can test hypotheses systematically. Becomes concerned with the hypothetical, the future, and ideological problems.

**Table 4.1 Piaget's Stages of Development**

Over the age range of 7–11 years, the concrete operational stage sets in where intellectual equivalents of cognitive level operators start to be made use of, but the start

is far from free of error. The term derives from dealing with non-abstract real objects and relations. Here Piaget discusses how the child learner acquires the process of reversibility (inversions and reciprocity, 1970) as related to conservation. With development, the child then is able to generalise groups of situations. At the age range 11–15 years, the formal operations stage develops: here basic abstract logic is handled and the ideas underpinning hypotheses formation are entertained. Here, interest ensues in theoretical issues and goes beyond direct factual information.

Johnstone (1987) offers a description of the last two developmental stages in the context of the sciences. In the penultimate stage, the learner is expected to apply problem-solving skills relating to direct experience. Here, he can think about or practically deal with physical objects. This is exemplified by abilities of cognitive organisation of entities into a possible set. By comparison, the last development stage deals with logical processes and greater possibilities such as those of hypothesising, designing experiments, setting rules, reasoning and deducing conclusions. Naturally, it is just such processes that scientists and science teachers endeavour to have in their learners, especially on progressing from secondary to tertiary levels of education.

#### **4.2.1 Criticism of Piaget's work**

While some have applied Piaget's work uncritically, others have engaged his work critically. Some proposed that a set of repeat studies would have been helpful, relating more to the thought processes of the learners as opposed to the inner logic behind them (Driver and Easley, 1978).

Of the criticism expressed relating to the specific qualitative development stages, the first was that of Ausubel (1978) who drew attention to the apparently inflexible range set for the cognitive development stages. The presented stages were merely those of

discrete bounded areas to be crossed while a more realistic graduation would be the norm to expect, progressing from a stage to the successive one. Piaget was not free from criticism even in methodological research. Errors were highlighted in his research, notably those relating to regard to statistical reliability, small sampling size and method and significance, even to the lack of age normative information. For some reason, he preferred presenting selected examples defending his model rather than applying rigorous statistical standard investigation (Ausubel, 1978). In addition, Bruner (1996) did not miss the chance to criticise the neglect of the effects of both experiential and environmental factors on cognitive development.

Overall, in looking back at Piaget's work, despite reservations about his methodology and the fact that the child tends to move through the four stages in a less abrupt manner than Piaget implied, Piaget's work has stood the test of time in being an example of acute and careful observation. He overemphasised the biological basis of cognitive development tending to neglect social and environmental factors. One of his major contributions was establishing that "*the child is not an 'empty container' to be filled with knowledge*" (Johnstone, 1987). The learner develops schemata in an attempt to make sense of experience. This is constructivist in tone and not unrelated in some ways to discovery learning. This resembled Bruner's later vision but differed with those models like Ausubel's that regarded both learning and teaching as mechanisms of learner receptive skills and teacher organisation and presentation.

Piaget's observations have some major implications for practical work. If skills like hypothesising, designing experiments, setting rules, reasoning and deducing conclusions only develop in the 12-16 age range, then the role of practical work cannot encompass these skills in their fullest sense until students have reached their mid-teens.

### 4.3 Bruner and the discovery learning model

Flavell (1963) noted how Bruner, despite his criticisms, still suggested that Piaget's model should be taken into account in developing curricula. Bruner's study into how cognitive processes added comprehension and organisation to experiences were greatly applicable to education in the subjects of mathematics and science. He proposed a general teaching guideline that relates to cognition. The active learning process was that of a social mechanism that formed new concepts in relation to a gained or prior knowledge. This cognitive process allowed the learner to choose and move information, form hypotheses, and decide. The effect that Piaget's research had on Bruner is shown in the latter's organisation of cognitive development, resembling that of Piaget (see table 4.2).

	<b>Bruner</b>	<b>Piaget</b>
Stage 1	Enactive	Sensori-motor
Stage 2	Iconic	Pre-operational
Stage 3	Symbolic	Concrete Operational

**Table 4.2 Bruner's and Piaget's Stages**

In 1986, Bruner argued that cognitive development is related to experience and not apparently to age. There was a focus on the process of representation, how learners organise knowledge. He proposed three specific modes: enactive, iconic and symbolic. The first mode, muscles knew the actions to perform. In the second mode, internal visualisation represented situations and relations. The third mode involved comprehending a symbolic system, such as mathematics and a foreign language. Progression then occurs by transition of a concept through the modes that would result in greater comprehension when all modes are used simultaneously. It should also be noted that Bruner noted Vygotsky's inspirational proposal (Bruner, 1986) that cognition and language were tools for planning and implementing actions.



One noted difference is that Bruner's stages are *not* related to maturation although the third stage is clearer in adult learners. He proposes that adult learners use all stages in dealing with information. Bruner makes a point that his model should take the learner's ability into account in acquiring knowledge and organising it. In agreement with Piaget, Bruner affirms the importance of learner motivation and information re-enforcement.

The ideas from Bruner were applied in science curricula, and discovery learning was sometimes employed extensively, although later research showed its limitations (Kirschner *et al*, 2006).

Ausubel (1968) emphasized reception learning while Bruner emphasized discovery learning. They are both correct in the sense that the learner needs a structure (offered by the teacher) for the learning process along with the freedom to develop understandings and insights. Piaget emphasized age-related cognitive development while Bruner focussed more on the cultural and linguistic.

The proposals of Bruner (1972) included:

- (1) *Developing a graduated spiral science curriculum that got more specific and difficult with time.*
- (2) *Highlighting the cognitive mechanisms in discovery learning rather than the content to be learned.*
- (3) *Placing concepts that are appropriate to age and ability.*
- (4) *Highlighting motivation and reinforcement.*
- (5) *Highlighting the amount and organisation of prior knowledge and not the quality, such as mental processes.*
- (6) *Relating cognitive development to linguistic development and not age as Piaget did.*
- (7) *Seeing that cognitive development may be elucidated from the learner's ability to comprehend words and symbols.*

Although Bruner differed with Piaget in the psychological nature of the perspective on knowledge (Bruner, 1966), it was the work of Piaget and Vygotsky (Bruner, 1986) that motivated Bruner to enter the field of cognitive development. Vygotsky's major

contribution was his appreciation that social environment was important in cognitive development, especially the stimulating effect of the learner being assisted by someone who was more developed cognitively. Bruner has contributed the idea of discovery learning and this has been taken somewhat uncritically into practical work. However, there are limitations for school students and discovery has to be guided very carefully.

Johnstone and Al-Shuaili (2001) noted that the method of allowing students to learn by discovering and by learning from their experiences advocated by Armstrong early in the twentieth century could be considered as the basis of discovery teaching. This way stipulates that students are asked to be involved in the problems and to seek answers themselves. It is not allowed to use any guide and the teacher's role is very limited. Johnstone and Al-Shuaili stressed that this heuristic approach is inductive. Although it is relevant to the inquiry method, the heuristic approach is different in the outcomes. While in the inquiry approach, both teacher and learner are looking for unknown results, the heuristic method adopts a way in which the learner is going to find out desired results. Bruner's view of heuristic learning (1967) states that discovery learning does not mean students are required to find out every bit of knowledge by themselves. Instead, they are asked to see the relationships between ideas and particles through employing what they know. It is the teacher's job to implant a sense of self-confidence inside the student. Bruner (1967) considered that there would be a radical change in the child's mental abilities if we gave him an "*attentive curricula design and deft teaching*". However, this is really unrealistic idealism .

Bruner (1983) offered a course called "*Man: A Course of Study*" to 75 children at the Underwood School in Newton, Massachusetts. He wanted to test new ideas that were being developed by researchers. The researchers worked with students for thirty days and they concluded that it was one of the most exciting experiences in their lives. Nonetheless, it is difficult to see how this method can be accommodated in school

where large numbers of students are present for short periods of time. Bruner (1966) argued that the process of learning is an active structure in which learners attempt to build up new notions rested on present or prior information. The learner examines and gains knowledge, raises hypotheses, and reaches results depending on his prior cognitive structure.

Cognitive structure gives sense and organization to experiences; it also permits the learner to reflect upon the information received. Bruner's approach is very similar to that of Piaget. They agree on the idea that students can formulate understanding if it has been offered in appropriate way. Although related to constructivism, research relating to the constructivism has, unfortunately, tended to emphasise the problems resulting from misconstructions rather than how the processes of information and understanding are built.

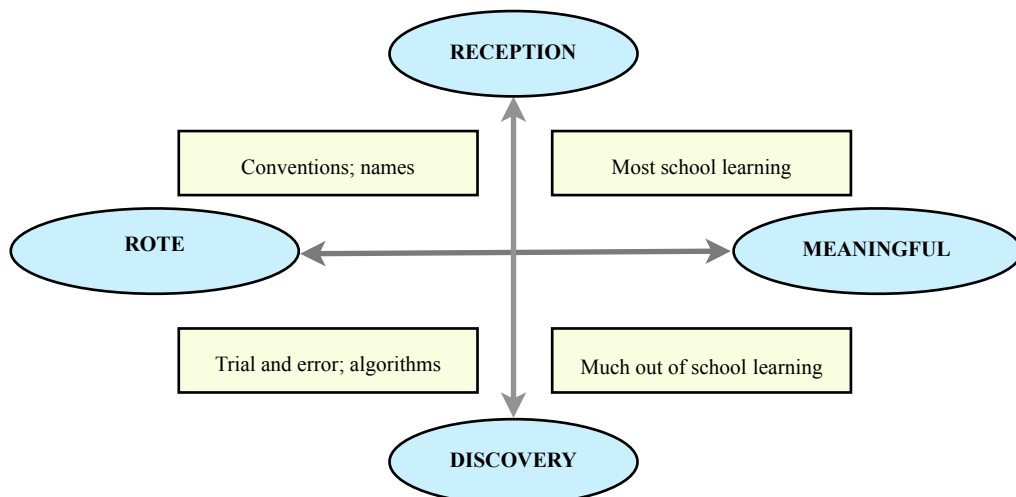
Bruner (1971) suggested that primary school students should learn information from a constructivist perspective rather memorising familiar texts. This illustrates the way he saw discovery learning as an antidote against the prevalent memorisation paradigm. However, curricula need to be specified in some way and Granger (1992) argues that a syllabus should be organised in a way that allows children to follow a structured body of knowledge at each different stage. For example, a logical stage would be the development and employment of a taxonomic scheme involving familiar fauna or plants. The steps of this syllabus should then be an extension to this study. It should examine differences among plants such as angiosperms and gymnosperm that lead to flower structure and function (Granger, 1992).

Cognitive hypotheses suggest that students are motivated to study by an inner need to acquire new knowledge but it is difficult for a student to make any major discovery in a few hours in a school.

#### 4.4 Ausubel and the Model of Meaningful Learning

In his research, Ausubel (1968) concentrated on the approaches to learning and the gaining of content from the curriculum differentiating between psychology and educational psychology. The former dealt with issues of learning and the latter dealt with the practical science of learning associated with effective approaches to the assimilation of organised information. Learning of new knowledge is facilitated when explained and related to appropriate concepts in the learner's mind and this process is said to be meaningful when new concepts are related to previous ones in the learner's mind.

Ausubel proposed a model (1969) which differentiates between the manner of learning and content presentation in the classroom. The manner of learning was either of rote or meaningful type and content presentation was either of reception or discovery kind. Hence four combinations are possible: rote-reception, rote-discovery, meaningful-reception and meaning-discovery (see figure 4.1).



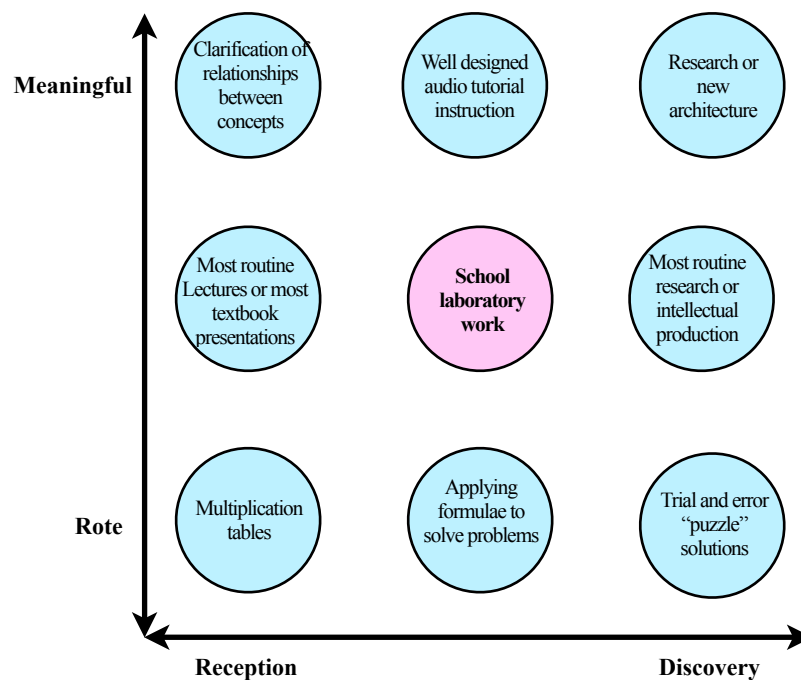
**Figure 4.1 Ausubel's two dimensions**  
(from Ausubel et al., 1978)

The clear separation of the two dimensions is a critical insight. Specifically, meaningful learning can occur when learning is largely reception in nature. Thus, teacher-directed learning can be highly effective in terms of understanding.

#### 4.4.1 Dimensions of the learning process

Contrary to Bruner's idea of discovery learning, Ausubel (1968) believed that it was essentially receptive skills that are utilised in gaining types of information. These skills concentrated on comprehensible verbal types of learning, the learning increasing with more organised and clear information. He placed no emphasis on rote learning. His interest lay in meaningful learning and he saw this being best achieved not through discovery but through organised, directed instruction from the teacher. The assumption made is that presentation from general to the detailed deductive is the aim, as opposed to Bruner's proposed inductive method.

Ausubel noted that either reception or discovery learning could be of meaningful or rote types of learning. He found that the two dimensions were unrelated. He exemplified the model (figure 4.2):



**Figure 4.2 Reception learning and discovery learning Examples**  
(from Ausubel et al., 1978)

#### 4.4.2 Meaningful and Rote Learning

Ausubel (1969) proposed that for learning to occur and be meaningful three criteria must be fulfilled:

- (1) **Content:** *They should be able to understand this and it has to relate to prior experience or using common sense.*
- (2) **Knowledge:** *for the meaning to be comprehended, sufficient prior knowledge should be available.*
- (3) **Learner:** *The intention should be to place new concepts in relation to prior knowledge for meaningful learning to occur, as opposed to rote learning.*

For rote learning, he proposed:

- (1) **Content:** *Lack of meaning and logical presentation.*
- (2) **Knowledge:** *Lack of related knowledge.*
- (3) **Learner:** *Lack of a learning set that is of meaning.*

However, it has to be noted that both meaningful and rote learning were not perceived as separate entities: there is a gradation between two extremes.

The order and quality of what is learnt is proposed by Ausubel (1978) to be founded on meaning. Of the conditions affecting this learning, it was proposed that prior knowledge was the most important. This type of learning dealt with organised and substantive knowledge. What this amounted to was an acquisition and assimilation of learnt knowledge *in relation to prior knowledge*. The process was not rote and it made sense. The condition, here, however, is that both prior and new information were linked: thus, learners recalled the main points of a recent lesson and linked to new input.

“*Empty pots to be filled*” was the misconception that Johnstone (1987) was emphatic about avoiding. Learners’ prior knowledge was proposed to affect the content and process of their learning. He stressed the importance of a personal reconstructed knowledge as opposed to transfer. The theme of relating prior cognitive knowledge to new input was again emphasised. Consequently, the learner deals with knowledge in an individual manner that relates to prior concepts, experience and motivation.

#### 4.4.3 Presenting the subject matter

Ausubel sees that academic knowledge should be presented in a structured form that is selected precisely and carefully so that it is organised in a successive manner (Al-Khaleely *et al.*, 1996). Organising knowledge to Ausubel is regarded as an aim in itself. Ausubel confirms, in this way, that each academic subject has an organised framework that is perhaps unique to itself. More comprehensive knowledge takes up the summit position, and under it is included less comprehensive knowledge. He strongly emphasises the necessity to teach each subject separately. He refers this to the fact that teaching subjects in an integrated manner “*erases the landmarks of the cognitive framework for each subject*” (Al-Khaleely *et al.*, 1996)

Applying Ausubel’s ideas, Novak (1984) suggested using concept maps for the idea of the subject matter to specify the main concepts at the top of the maps which is then followed by branch concepts, more branched concepts and so on. The teacher has to present the main concepts first and move gradually towards the branch concepts. The figure 4.3 shows a simplified diagram of concept maps for planning a teaching programme.

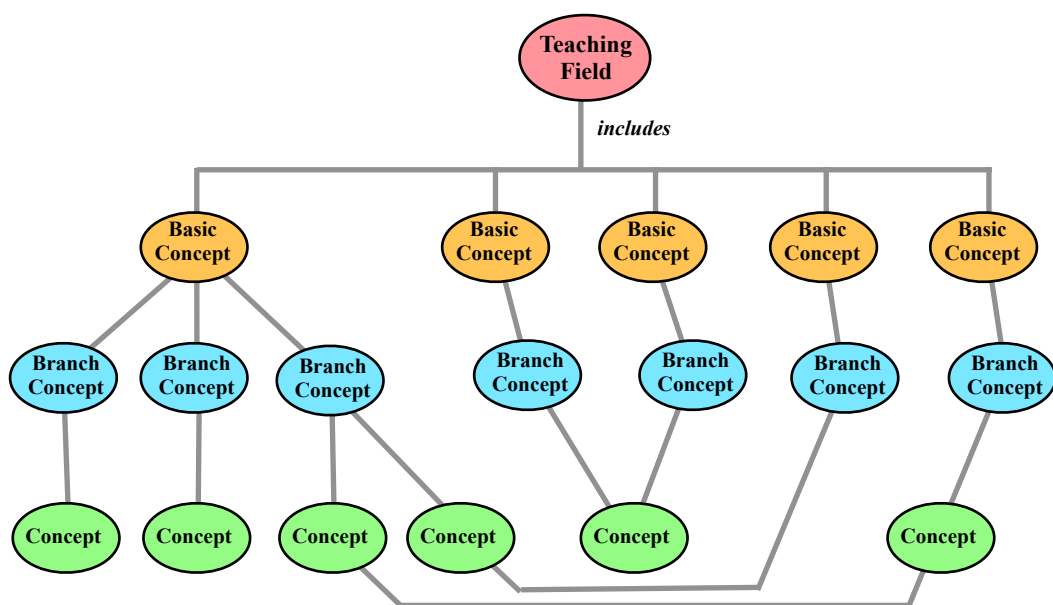


Figure 4.3 Simplification of concept map for planning a teaching programme

It is possible to conclude that Ausubel confirms the necessity of organising the concepts to be learned from general to detailed. At the beginning of his writings, Ausubel confirmed that the teacher should provide his students with what he called advanced expert system (*'advanced organisers'*) (Al-Khaleely *et al.*, 1996). Such expert systems are at a higher level of generality and comprehensiveness than the material to be taught. The purpose of this is to support the learner's ability to organise the new subject and learn it. Similarly, the expert system will help to form the connecting links which will facilitate linking the new concepts with the individual's cognitive framework in a pyramidal manner.

To implement Ausubel's model in the classroom, Novak (1984) described concept mapping as a method with three stages: presenting the concept, specifying the position of the concept in relation to other concepts and specifying the lateral relation between the concepts. Figure 4.3 compares such steps with Ausubel's concept formation. Al-Khaleely *et al.*, (1996) offers some advice to help teachers in the classroom:

- (1) *Specify the learners' primary concepts about the concept to be learned.*
- (2) *Plan the lesson according to the learners' primary concepts so that the lesson provides learning concepts in place of the primary concepts and the learning is meaningful for the learner.*
- (3) *Start by giving generalities before details and the concrete before the abstract.*
- (4) *Design questions that help students to discover aspects of similarities and differences between the concepts that they have learnt.*
- (5) *Give the students the opportunity to air their opinions so that they see the different opinions.*
- (6) *Give the students the opportunity to discover the pyramidal sequence of the concepts.*
- (7) *Always help the students to reach the stage of holistic integration through comparing their new concepts with their prior concepts.*



#### 4.5 Neo-Piagetian models

While Bruner and Ausubel were developing new and fresh ways to look at learning, a number of other researchers tried to build on the ideas of Piaget more directly. Their aim was to seek to find some kind of explanations for Piaget's observations. Among these, a notable psychologist in the field of education was Pascual-Leone. His neo-Piagetian stance was to continue the '*computer general psychological theories*' theme rather than contest the model of Piaget. In 1974, Pascual-Leone proposed his neo-Piagetian version of cognitive development. It basically stated that any person's intellectual process resulted from three factors acting on the cognitive framework. These were the process applied to the cognitive task (repertoire H); the cost on the cognitive framework paid for the process (M-demand) and the idiosyncratic cognitive framework present (central computing space, M operator or M-space).

Using a computer central processing unit analogy, Pascual-Leone's model referred to Piaget's stages of cognitive development as qualitative descriptors of a learner's internal computing system or M-capacity. Thus, the M-capacity increases with the Piagetian stages of cognitive development (in other words, it grows with age). This still developed from the genetic influence on cognitive development: factors of genetics and growth caused some changes in M-space.

In the same year as Pascual-Leone's model, Case (1974) proposed that the model was based on Piaget's schemata principle. Schemata acted as the '*mental blueprints*' of prior experience and led to human behaviour. A bank or '*repertoire*' of a significant number of '*schemata*' was seen to be able to elicit responses.

The neo-Piagetian approach is important because the computer analogy contributed to the understandings that arose in information processing.

## 4.6 Information Processing Models

A quick literature review here reveals many descriptions of information processing models (*e.g.* Atkinson-Shiffrin, 1971; Sanford, 1985; Child, 1993). A comprehensive model is that of Johnstone (1993) where he proposes how meaningful learning results from processing input information. His model has incorporated other learning models (significantly Ausubel, 1969, and Ashcraft, 1994).

In all information processing models, there are three proposed types of memory (long term memory, working memory, sensory memory) as well as mechanisms for transferring information between them. Ashcraft (1994) uses the computer processing analogy for explaining cognition in terms of selecting, coding, storing, retrieving and processing information. This is typical of cognitive psychology research where the interest is in concept development and problem solving (Eysenck, 1994) and memory, attention, thinking and reasoning (French and Colman, 1995).

### *Sensory memory*

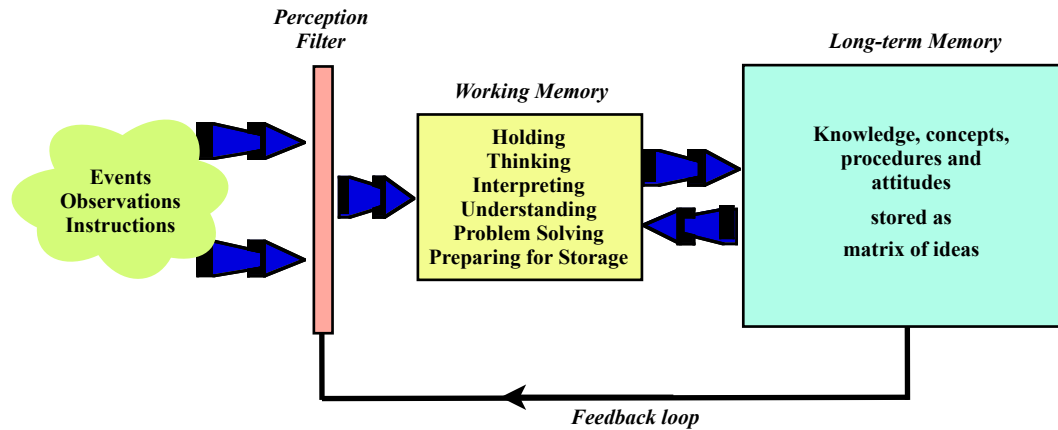
Two forms are outlined by Ashcraft (1994): the visual and the auditory forms. The first holds information for about one second whereas the latter lasts for about four seconds. After the stimulus is received a high-capacity mechanism acquires this and stores it in its original form for a very short time. This sensory memory is defined as the ongoing or continuing process of perceiving a stimulus after it is not present.

White (1988) discussed the important selections of the learner to be:

- (a) *Modified by factors of ability, attitude and prior concepts.*
- (b) *Dependent on factors of characteristics of the learner and circumstances and dealing between both.*

The “*perception filter*” (see figure 4.4) was Johnstone’s (1993) description of sensory memory. This receives all observations, circumstances and instructions. The perception

filter is influenced by what is held in long term memory. It is impossible for everything to be selected (the working memory would be permanently overloaded) but the basis of selection is previous beliefs, biases, likes and dislikes and prior concepts.



**Figure 4.4** A model of information processing (after Johnstone, 1993)

#### *Short-term memory*

The terms short term memory (used by: Atkinson and Shiffrin, 1971; White, 1988) and working memory (used by: Schneider and Shiffrin, 1977; Baddeley, 1986; Johnstone, 1988) describe the same memory space but emphasise different functions. Characteristic differences were pointed out by Johnstone (1984) between both descriptions. In short-term memory, learning a set of digits, recalling them in sequence in seconds implies no processing in short-term memory. However, if the learner is asked to process the numbers by adding then multiplying by the first digit, the space is functioning as working memory. Johnstone's (1984) definition of working memory is "*that part of the brain where we hold information, work upon it, organise it, and shape it, before storing it in the long-term memory for further use.*"

One distinguishing feature of this memory is the restriction in terms of capacity and time of storage. The former has been measured as 'seven plus or minus two' memory units (or 'chunks', as shown by Miller, 1956). Information here is stored in distinctive chunks, each controlled by prior knowledge, experience and skills (Johnstone and El-

Banna, 1986). The term chunk is used to mean a unit of information as perceived by the learner (word, words, number, numbers, formula, picture etc). Eysenck's (1984) version of a chunk proposed a familiar structure founded on prior learning.

An illustration of chunking information was presented by Johnstone and Kellett (1980) in the form of specialists (i.e. scholars, lecturers) and beginners (i.e. learners) in chemistry deciphering formulae (eg. the formula for methylamide). The specialist perceives this as one unit while the learner may see it as numerous units, perhaps anything from letters and lines to some kind of linkage between functional groups.

*"The mental workplace for retrieval and use of already known information"* is how Ashcraft (1994) described working memory. Short-term memory implied a transient static storage whereas working memory implies action restricted by its capacity. The processing possible is inversely proportional to the information handled, as confirmed by Baddeley (Baddeley and Hitch, 1974; Baddeley, 1992). Information can be held in working memory for up to one minute (Craik and Lockhart, 1972). On reflecting on a concept, this may cause the information to stay in working memory longer as one deals with new or prior knowledge. For in-depth treatment of working memory models, one can refer to Baddeley (1995). However, it is important to note several observations from this:

- (a) *When there is much information, there is little room for processing;*
- (b) *When much room is needed for processing, the amount of information which can be held will be small;*
- (c) *Working memory capacity cannot be altered;*
- (d) *Working memory can be used more efficiently but this is not taught easily;*
- (e) *When working memory overloads, learning more or less ceases.*

Atkinson and Shiffrin's model (1971) recognises that working memory is the same as short-term memory. The space can be used to hold information and/or to think about information. More recently, Bruning *et al.* (1995) emphasizes its restricted capacities, either through quantity of content or duration. After information is processed, it is stored in long term memory.

### *Long-term memory*

The long term memory is where information is stored. It is thought that the store is permanent and of infinite capacity (Solso, 1995) although that does not guarantee easy recall. Recall is easier if the information is linked in multiple directions, making access easier. Craik and Lockhart (1972) discuss how higher order processing procedures improved concept retrieval as a result of increased input elaboration and association with prior knowledge in the long-term memory. However, it must be noted that the linkages seem to be formed in working memory when new ideas are linked on to previously held information and ideas.

Classification of long-term memory was presented by Tulving (1986) into episodic and semantic knowledge storage. The former was more idiosyncratic (i.e. ‘feelings of achievement’) whereas the latter was more general (i.e. ‘Baghdad is the capital of Iraq’). Johnstone *et al.* (1994) discuss the use of long term memory as a store of information and ideas, as well as feelings and attitudes. In 1983, Kempa and Nicholls proposed that learners’ abilities at algorithmic problem solving related to their long-term memory constitution and this was supported by evidence gained by Reid and Yang (2002).

#### **4.6.1 Flow of information**

Looking at the information processing model from Johnstone (see figure 2.6), the way information flows can be seen and this is now discussed.

##### *(a) Perception (filtering, admitting and enhancing)*

The senses perceive external information (i.e. experiences, images, words) through the perception filters (sensory memory). The latter receives the inputs and the person filters some, concentrates on others and leaves others. Using a communications analogy, the

person tunes in to the ‘*signals*’ and filters out the background ‘*noise*.’ The signals here are the familiar, i.e. what is believed to be of benefit, concern or motivation; and the noise is superfluous input. Assimilation is where there is input from prior belief, experience or even misconception to the information and processing to meaningfulness. Johnstone (2000) explains how the control of this process is affected by prior concepts and learning.

Understanding of perception is useful in looking at information processing. The perception process and attention are guided by prior concepts. Other mechanisms are involved, such as enhancement and interpretation. The acquisition, recognition and even meaning of input may be markedly affected by prior concepts. The incoming information, once selected, is passed to the working memory for processing.

*(b) Holding and thinking*

Baddeley (1986) notes how working memory plays both concurrent roles of holding and thinking in the same restricted space. In this conscious cognitive area (working space), filtered information undergoes processing. Associations are looked for, relationships between acquired and prior concepts are examined, links are formed or built on and concepts are assimilated before storage or rejection. The working space holds the information for processes such as ordering, linking, shaping, modifying and associating with prior concepts held in long-term memory (for output to occur, information must pass from long-term memory to working memory).

Ordering, linking to prior concepts, assimilation and return to long-term memory for storage then recall is performed on new concepts. The latter may then feedback on the preceding process modifying filtration. Again, it is researchers like Baddeley (1986) who have studied this in some detail.

A person decides whether to pass information on to long-term memory or produce a permanent copy, eg. writing. The working memory then receives the information on ‘*temporary hold*’ before the next stage of processing. On leaving working memory, information is lost for good unless stored in long term memory or committed to a permanent form like writing.

*(c) Storage and retrieval*

The processes of passing learned information from the working space on to long-term memory are for storage and provide the ability to simply recall and use it. However, the storage may occur in several ways, not all of which are ideal:

- (1) *Rote learning: Non-connected learned concepts (Ausubel, 1978).*
- (2) *Meaningful learning: Logically connected learnt concepts to prior ones with addition association and simple access to them (Ausubel, 1978).*
- (3) *Developing misconceptions: Here new ideas may be linked incorrectly to previous knowledge leading to alternative frameworks or misconceptions.*
- (4) *Storage may be in a sequence: as with learning the alphabet, tables, or such skills as the procedures to carry out some practical operation.*

In most circumstances, meaningful learning is the most desirable outcome. Here new information, ideas or concepts are linked correctly on to previously learned ideas; both are enriched. Ideas expand and there are increasing numbers of meaningful links being formed between related themes. Both rote learning and sequential learning have their place but the formation of misconceptions about which there is a huge literature (e.g. Driver and Valerie, 1986; Solomon, 1994) is a natural if undesirable outcome. The possibility of this emphasises that meaningful links must be specified by the teacher and checks need to be made to see if such links have, in fact, formed. This relates strongly to Ausubel’s ideas on advanced organisers (Ausubel, 1968).

*(d) Pattern recognition (feedback)*

A model is proposed whereby an input reaches the perception filter and a connection with long-term memory indicates whether this has been met and stored previously. Issues with this include those of restriction of working space, occasional non-existent prior concepts and erroneous associations. One cannot over-emphasise the role of prior knowledge as Ausubel *et al.* (1978) put it, “*the most important single factor influencing learning is what the learner already knows.*” This comprises belief, bias and preference. Learners of similar nationalities and customs resemble each other in this but still differ in idiosyncratic personally held beliefs and knowledge. In 1976, Garforth *et al.* and, more recently, Nakhleh (1992) highlighted the possible formation of other frameworks and misconceptions. Defects in information perception and processing may be caused by error in the preceding process. Taber (1996) states how this may positively feedback to cause more wrong storage and formation of other frameworks and misconceptions. Johnstone (1997) notes how defective or under-selective filtration leads to gaining ‘noise’ (extraneous information) in the working space. Consequently, the learning is hindered or occurs erroneously.

**4.6.2 ‘Working space’ overload**

As far back as 1956, Miller talked about short-term memory (*his* phrase) confirming that its role was to hold information (seven plus or minus two) without modification. More information can be held if chunking ability is high.

The finite capacity of learners to hold a set of concepts or ideas in answering questions was studied by many. It transpired that there is only so much room for all the working space processing of information acquisition, retrieval of prior concepts and skills from long-term memory, assimilation, linking, deciding, ordering, reshaping and restoring for



later use (Johnstone, 1984; Johnstone and El-Banna, 1986). Study on working memory showed its role to be one of holding and modifying information (Johnstone, 1984). In comparison to Miller's work, Johnstone elaborated on how students' learning decreased dramatically when the load of a task was beyond their working memory capacity.

If the learner cannot distinguish easily between signal and noise, it is easier for the working memory to overload. This is particularly true in laboratory learning where the amount of information can often be very great. Working memory overload was observed by Johnstone and Wham (1982) and Johnstone and Letton (1991). Important recommendations for circumventing this were stating clear learning outcomes and providing carefully ordered and presented resources. It is to be noted that information held in working memory space may be replaced if there is no process to secure against this by dealing with and organising it. This could involve chunking, selection and filtering noise.

#### **4.6.3 Applying the model**

Various studies of university laboratory learning in chemistry showed students following instructions, with rare attempts at interpreting or understanding (Johnstone and Wham, 1982; Johnstone, 1984). For lectures, students were found to record about 10% of what was said (Su, 1991). Even this was found to be less efficient as the information load increased. In another study, Vianna carried out pre- and post-laboratories for a chemistry experiment and also looked at project work integrated into traditional experiments (Johnstone *et al.*, 1994). They demonstrated the key effectiveness of pre-laboratory experiences in enhancing learning. They also showed how mini-projects can be used effectively and linked these to pre-laboratory exercises. These exercises prepared the mind for learning by reminding students of background

understandings, introducing new ideas, and directing students about what was expected. All of these reduce the load on working memory, allowing students to be able to think about what they were doing rather than just following a laboratory manual like a recipe. All of this was predicted by insights from information processing.

In another large study at higher education level, in a physics setting, Uz-Zaman (Johnstone *et al.*, 1998) devised an ingenious study. This looked at four physics experiments with first year university students. They were able to compare the performance of the students with and without pre-laboratory exercises on all four experiments. They found a quite amazing improvement in understanding when students had undertaken the pre-laboratory exercises. They also found a remarkable change of student attitudes towards the laboratories, students being much more positive when pre-laboratory exercises were used.

This study stresses the importance of students gaining satisfaction in their learning when their learning leads to understanding rather than rote procedures. This will be just as important in schools. Students may develop negative attitudes when they are unable to make sense of what they are asked to do and what the purpose of it is. This was further explored by Jung in South Korea and she showed the linkage between trying to understand and positive attitudes (Jung and Reid, 2009).

#### **4.7 Problem solving**

Quality education needs to consider the way it prepares the learners for future life. A major aspect of all living is the ability to solve problems. Indeed, Yang (2000) noted that, ‘.... we can say that life is a problem solving process’. However, one problem lies in knowing how to define a problem.

According to Wheatley (1984), problem solving is defined broadly as '*what you do when you don't know what to do*'. Gagne (1977) stated that problem solving can be viewed as a thinking process by which the learner discovers a combination of previously learned rules that he can apply to solve a novel problem; it is also a process that yields new learning. Ashmore *et al.* (1979) defined problem solving as the result of the application of knowledge and procedures to a perceived problem and they classified problems on two dimensions: the nature of the solution required (goal state) and the sources of information (initial state) which must be employed. Perez and Torregrosa (1983), in their work relating to physics, saw problem solving as a scientific investigative task, while Mayer (1997) viewed problem solving as almost the same as with thinking. Ausubel *et al.* (1978) defined problem solving in terms of meaningful (but not a completely autonomous) discovery learning.

Hayes (1981) defined a problem as what exists '*whenever there is a gap between where you are now and where you want to be, and you don't know how to find a way to cross that gap*'. This is, perhaps, the most useful picture but it implies that much that is called problem-solving in schools fall into the category of being exercises rather than problems.

Thus, the Scottish Qualifications Authority (1997) set up a list of problem solving abilities: selecting information, presenting information, selecting procedures, concluding and explaining, prediction and generalising. While each of these abilities is frequently required in problem solving, collectively they cannot claim fully to enable a student to undertake any possible problem solving. Indeed, in many examination papers, the supposed problem solving questions are simply the applications of known algorithms.

Problems have been categorised in several different ways. For example, Greeno (1978) and Greeno and Simon (1988) suggested a four-part typology of problems: transformation; arrangement; inducing structure; deductive arguments. A very helpful classification of problem types has been made by Johnstone (1993). He suggested that there are three variables associated with all problems:

*The data provided*

*The method to be used*

*The goal to be reached*

By looking at the extremes where each variable is either known or unknown, he came up with eight problem types. The eight types of problem are shown in Table 4.3.

Type	Data	Methods	Goals/ outcomes	Skills bonus
1	Given	Familiar	Given	Recall of algorithms
2	Given	Unfamiliar	Given	Looking for parallels to known methods
3	Incomplete	Familiar	Given	Analysis of problem to decide what further data are required
4	Incomplete	Unfamiliar	Given	Weighing up possible methods and then deciding on data required
5	Given	Familiar	Open	Decision making about appropriate goals. Exploration of knowledge networks
6	Given	Unfamiliar	Open	Decisions about goals and choices of appropriate methods. Exploration of knowledge and technique networks
7	Incomplete	Familiar	Open	Once goals have been specified by the student, these data are seen to be incomplete
8	Incomplete	Unfamiliar	Open	Suggestion of goals and methods to get there; consequent need for additional data. All of the above skills

**Table 4.3 Classification of problems (Johnstone, 1993)**

Types 1 and 2 are the ‘*normal*’ problems usually encountered in textbooks and examination papers. Type 1 is of the algorithmic nature and can be regarded as an ‘*exercise*’. The type 8 problem is the nearest to real-life problems but this type is not necessarily more difficult than any other type. In fact, Johnstone never intended that the eight types would be seen as hierarchical. Thus, he did not imply that anyone proceeds from type 1 to type 8 as a kind of development in problem solving skills. Overall, this is a most useful classification, being simple and relatively easy to apply and understand.

#### 4.7.1 Ways to Solve Problems

Early experimental problem solving tasks were mainly ‘*content free*’. Most of them seem to be ‘*game-like*’ and people obtained the solution without specialised knowledge. Polya (1945) proposed a model of problem solving that consists of four steps: understand the problem; devise a plan; carry out the plan; look back. The initiation of the model is based on solving mathematics problems and it may be suitable for a routine exercise but is not a model of the way people usually solve real problems.

The information processing model developed by Johnstone (Johnstone and El-Banna, 1986; Johnstone, 1997) suggests some of the key features of mental activity that might be the limiting factors in problem solving ability. Of these, two factors may be particularly important. The limited capacity of the working memory space (where the actual process of problem solving is occurring) may be a significant factor in that, if the process of problem solving involves too much space (in terms of ‘*chunks*’ of information and/or processing), then problem solving may be impossible. However, if writing and talking with others is possible, then the effect of this limited capacity may be reduced. Second, the vital importance of previously held knowledge can be seen. This can influence the way the problem solver actually ‘*sees*’ the problem as well as the way such knowledge can be used to solve the problem.

#### 4.7.2 The Factors Influencing Success in Problem Solving

In the literature, there are numerous factors which have been found to be important in influencing problem solving success. Gabel and Bunce (1994) proposed that students’ success in problem solving appears to be influenced by three groups of factors: the nature of the problem and the underlying concepts on which the problem is based; the learner characteristics, including cognitive styles, developmental levels and their

knowledge base; and, learning environment factors, including problem solving strategies or methods, individual or group activity. Following the line adopted by Gabel and Bunce, some possible factors which might influence success in problem solving are now considered in turn.

#### *Prior Experiences and Successful Problem Solving*

What a person knows and their experiences in gaining that knowledge are clearly important (Ashmore *et al.*, 1979; Frazer and Sleet, 1984; Waddling, 1988; Gayford's (1989). Knowledge is stored as networks in long-term memory and this affects future problem solving success (Ashmore *et al.*, 1979; Waddling, 1988; Al-Qasmi, 2006)

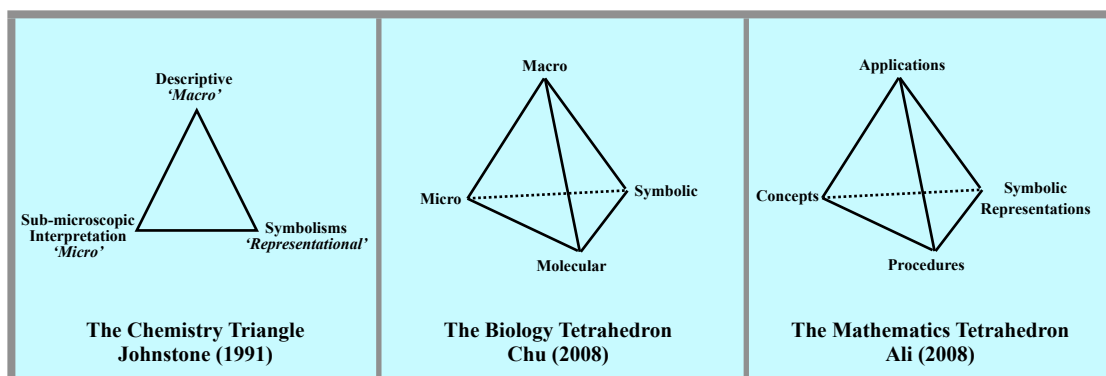
#### *Prior Knowledge Base and Problem Solving*

Although key essential knowledge is important (Frazer, 1982), much work has indicated that students failed to solve problems, even though they possessed most of the requisite conceptual knowledge (Sumfleth, 1988; Shaibu, 1992; Adigwe, 1993; Lee *et al.*, 1996).

In a large study, Adigwe (1993) found four factors [attitude, logical thinking ability (proportional reasoning ability), knowledge of chemistry, and knowledge of mathematics] were considered to play some role in problem solving with algorithmic chemistry problems.

#### *Knowledge, Learning and Problem Solving*

Learners find some topics difficult and this affects problem solving success. This is most marked when themes move into the abstract. Students have great difficulty here and it is usually because they cannot handle knowledge at several levels simultaneously. Johnstone illustrated this with his famous '*Chemistry Triangle*' (which also applies to Physics), later extended to Biology by Chu (2008) and Mathematics by Ali (2008) (figure 4.5 overleaf):



**Figure 4.5 Triangle and Tetrahedra**

It is hard for pupils to learn if they have to handle these three (or four) aspects of knowledge simultaneously. This is simply a function of limited working memory capacity. This may have significance in problem solving in that, if a problem requires confidence in moving between all three levels, then a source of difficulty has been introduced at the outset which hinders successful problem solving.

#### *Cognitive Structure and Problem Solving.*

The cognitive structure existing in pupils' minds has been considered by many researchers as an important factor which affects problem solving (Kempa and Nicholls, 1983; Lee, 1985; *Lee et al.*, 1996). Ausubel et al., (1978) note that meaningful learning involves effective linking between new knowledge and existing cognitive structure.

In an important study, Kempa and Nicholls (1983) found that the cognitive structures of good problem solvers are more complex and contain more associations than those of poor problem solvers. It was also revealed that the deficiencies in the cognitive structures of poor problem solvers appear predominantly for abstract concepts. Although this study used problems mainly of an exercise or algorithmic nature, its findings were also found to apply in more open-ended problems (Reid and Yang, 2002b, Al-Qasmi, 2006).

### *The Effects of Co-operative Group Work on Problem Solving*

Problem solving is typically not a solitary activity but one where several individuals join together to accomplish shared goals (Johnson and Johnson, 1975). Qin *et al.* (1995) examined 46 studies published between 1929 and 1993 to determine the relative impact of co-operative and competitive efforts on problem solving success. Overall, cooperation was more beneficial. They also found that solving an ill-defined problem requires generating a creative or novel representation and procedure primarily through imagery. The evidence indicated that co-operative efforts resulted in better performance in these ill-defined problems. This may be due to individuals exchanging ideas and building a shared representation of the problem through group discussion.

The nature of the small co-operative group has been described by Slavin (1983), while several studies have examined the effects of co-operative group work on science achievement and learning (Grant, 1978; Tingle and Good, 1990; Basili and Sanford, 1991; Kempa and Ayob, 1991, 1995). Working with university students, Basili and Sanford (1991) provided evidence that the co-operative approach is effective in both mathematical and conceptual problems. In addition, Qin *et al.* (1995) concluded that the difference between co-operative efforts and competitive efforts on problem solving is greater for older participants than for younger participants.

### *Problem Solving, Algorithms and Conceptual Understanding*

It is clear that students do not always use algorithms to solve problem and, more often, they need other skills to reach a solution. Bodner (1991) insisted that there is more to working problems than just applying algorithms in the correct order. On the other hand, Frank *et al.* (1987) argued that algorithms are not necessarily bad and some of them are useful shortcuts for exercises. However, algorithms may actually prevent understanding when students encounter a real problem (Reid and Yang, 2002b). Numerous studies



have shown that strict adherence to instruction that emphasises algorithmic problem solving in chemistry does not produce conceptual understanding in students (Nurrenbern and Pickering, 1987; Sawrey, 1990; Pickering, 1990; Nakhleh, 1993; Nakhleh and Mitchell, 1993).

### *General Problem Solving Strategies and Problem Solving Skills*

Unsurprisingly, Greenbowe (1983) found that successful problem solvers exhibit more effective skills such as organisation, persistence, evaluation, heuristics and formal operations than unsuccessful problem solvers but the skill of representation is important. It has been noted that the skill of problem representation is important (Greenbowe, 1983; Bodner and Domin, 2000). Problem representation may be internal (imagining the objects and relations in the mind) or external (sketches, diagrams, symbols, equations) (Hayes, 1981; Simon and Simon, 1978). Bodner and Domin (2000) concluded that one of the characteristic differences between successful and unsuccessful problem solvers is the number and kinds of representation brought to the problem.

### *The Role of Long-term Memory in Problem Solving*

Gabel and Bunce (1994) suggested that '*how science concepts are networked in long-term memory, and the ease of transferability to working memory are important conditions leading to success or failure in problem solving*'. This is consistent with the arguments put forward by Ausubel *et al.* (1978) and is suggested explicitly by the information processing model (Johnstone and El-Banna, 1986). It is also supported by others (Kempa and Nicholls, 1983; Reid and Yang, 2002b; Al-Qasmi, 2006). In simple terms, it is not just the stored knowledge that is important. It is the way the ideas is linked to together in long-term memory that is more important. Well-networked ideas means the material understood. If material is understood, then it is more accessible and can be applied in novel situations.

### *Working Memory and Problem Solving*

Working memory capacity is known to be a critical factor in problem solving success (Johnstone and El-Banna, 1986, 1989; Johnstone, 1991, 1997; Reid and Yang, 2002a, Niaz, 1987, 1988a,b,c, 1989). However, Niaz also noted the importance of learning styles. Hindal (2007) found several learner characteristics which were important in learning, one of which is the extent of field dependency.

Several studies have looked at this variable in relation to problem solving. Four research investigations (Lawson and Wollman, 1977; Squires, 1977; Ronning *et al.*, 1984; Pirkle and Pallrand, 1988) all focused on field dependency within science. These studies were examined by Helgeson (1994) collectively and the evidence from those studies clearly indicated that high school students who are field independent enjoy a significant advantage over field-dependent students in solving science problems contra (Chandran *et al.*, 1987), an observation confirmed by others (Al-Naeme and Johnstone, 1991; Danili and Reid, 2004)

### *Problem Solving and Teaching*

There is little evidence to suggest that there are any generic problem solving skills. However, some specific skills can be taught which apply in specific types of problem (Wallace, 2012). However, it is possible that the development of problem solving skills is hindered by the way assessment emphasis algorithmic exercises with specific ‘right’ answers. This seems to be confirmed in a study by Phelps (1996) who tried to bridge the gap between conceptual understanding and algorithmic problem solving by altering the instructional method in general chemistry courses. Thus, it would appear that it is possible to change the instruction method and to adjust student expectations, with outcomes that students are able to change their strategies. a finding confirmed by Wallace (2012).

Indeed, co-operative grouping may be an important strategy in that allows a much greater freedom to develop a wider range of skills in an unthreatening atmosphere (Tingle and Good's, 1990). Thus, co-operative groups may enhance students' problem solving ability, consistent with the observations by Yang (2000) and Gabel and Sherwood (1983). Practice in groups offers cognitive support and the practice may allow the learners to gain confidence in the application of appropriate methods and algorithms. It may be that practise in such problems raises levels of confidence and generates a willingness to take what Reid and Yang (2002b) call '*cognitive risks*' in seeking solutions.

#### 4.8 Assessment

Assessment often controls, or at least strongly influences, what is learned and how it is learned. Assessment powerful effects on learning (Crooks, 1988). The technology of assessment has been such that these effects are usually for the worse. Ramsden, 1984:144) describes the comment of a Psychology student:

*"I hate to say it, but what you have got to do is to have a list of facts; you write down the important points and memorise those, then you'll do all right in the test... if you can give a bit of factual information-- so and so did that, and concluded that-- for two side of writing, then you'll get a good mark".*

When it is perceived that grades in tests and examinations can be maximized by accurately reproducing detail, no matter what the tester is seeking to do, both teacher and learner will focus on that content, and use teaching and learning strategies to enhance retention. However, when testing is seen to require higher order thinking, the challenge for both teacher and learner is accordingly different and will require higher order strategies from each.

Assessment can refer to individual tasks, as it usually does, or to understandings of the course as a whole (Trigwell and Prosser, 1991). Institutional evaluation is usually expressed in grades, and tends for various reasons to be quantitative to the point that it may even be unrelated to qualitative evaluation (Trigwell and Prosser, 1991). Affective outcomes refer to the students' feelings about the learning experience. Feedback from all these sources has important effects: on the student's future expectations, motivation, and metalearning decisions; and (hopefully) on the teacher's future teaching-related or meta-teaching decisions. Assessment is, therefore, a strong influence on the quality of learning.

#### 4.9 Conclusions

This chapter has considered the contributions of several researchers is seeking to understand the way the learning occurs and how to enhance understanding as an outcome. Some of the key contributions can be summarized as in table 4.4.

Researcher	Broad Conclusion
Piaget	Learners move through a series of age-related stages in cognitive development
	Learners are seeking to make sense of the world around and they construct their own understandings
Vygotsky	Learning is a social activity and can be enhanced when a slightly more advanced learner supports
Ausubel	What the learner already knows controls future understanding
	The extent of understanding is independent of the extent of directed learning or discovery learning
Bruner	Learners can use a series of strategies developed by means of experience
	Learners are encouraged and motivated by the freedom to discover
Pascual-Leone	Learning is controlled by the cognitive demand of the task related to the mental capacity available.
Johnstone	The limited and fixed capacity of working memory controls all understanding
	A learning task is almost impossible if it makes a demand greater than the capacity of working memory
Reid and Yang	Greater skills in understanding and problem solving occur when understandings are stored in highly linked ways in long-term memory
Several	Assessment formats and styles control what is learned and the goal of that learning

**Table 4.4 Brief summary of some key contributions**

The information processing learning model has offered many clear guidelines which have been supported by empirical measurement:

- (1) *Learner preparation is important to help learning and avoid misconceptions as shown by research incorporating pre-lectures.*
- (2) *The manner of information storage is important for later retrieval. The major factor in helping learning is associating new concepts with prior ones.*
- (3) *Care must be taken not to overload the working memory space of learners. Teachers must ensure that there is no excessive 'noise' and that the 'signal' is clear. Later, 'noise' can be added carefully to develop skills of selection.*
- (4) *Information held in long-term memory controls information perceived and attended to. The teacher needs to know what is already known.*
- (5) *New concepts are controlled from retrieved information from long-term memory. Here efficiency is aided by chunking.*
- (6) *Retrieval is easier when storage is in meaningful form: not stored from rote learning form as isolated facts*
- (7) *Erroneous storage may affect perception and processing and this can result in forming misconceptions.*

It has to be recognised that the educational models which have been discussed here were developed on the basis of empirical evidence and careful observation. Each model tended to look at the process of learning from some specific standpoint. Thus, no one model encompasses all aspects of learning. There is a need for a holistic approach.

The information processing model (as developed by Johnstone *et al.*, 1994) has brought together many of the insights from other models. It is also predictive, sometimes offering quantitative analysis. Of course, the model is still developing and may have to be modified further. Indeed, at the moment, there are attempts to interpret learner characteristics in terms of the model (Hindal, 2007).

The insight from research evidence about the learner learns are critical in considering quality assurance. If teaching is not consistent with the known understandings that enable efficient and effective learning to occur, then quality is compromised. This insight was captured many years ago by Johnstone when he write, in the context of

learning in chemistry his paper entitled, '*The Teaching of Chemistry – Logical or Psychological?*' (Johnstone (2000)). In reviewing the evidence of his long research career, the point he was stressing was that, from the stage of curriculum construction through to the entire process of teaching and assessing, it was imperative that everything was conducted in the light of what we *know* about how the learner learns. The logic of subject disciplines is a secondary issue.

Thus, it is critically important that, in curriculum construction and textbook writing, no one model is followed to the exclusion of other insights. However, inasmuch as information processing has captured the insights of many other models, it does offer a straightforward guide to curriculum planning (see Mbajorgu and Reid, 2006). It is also important that teachers become increasingly aware of the contributions of such understandings of learning and that pedagogy is consistent with the evidence on effective and efficient teaching and learning. This will be particularly true for quality learning which is set in a complex learning environment where the aims are not always clear.

This offers a strong direction for all attempts at quality assurance. The curriculum and the assessment must be consistent with the best evidence on learning. Decisions on both of these lies outwith the control of the schools and the teachers. In addition, the teaching strategies also need to be consistent with the findings from the research evidence. This immediately implies that those who deliver teacher training and inservice training are conversant with what research has revealed. This takes quality assurance well beyond the realms of simply observing teachers teach.

Any attempt at considering quality assurance with secondary stage learners (age 15-18) needs to consider the extent to which the curriculum, the assessment, and the teaching strategies are all consistent with the findings from the research evidence. This means

that those involved in assessing quality must be fully aware of that evidence and how to gain evidence that the learning processes are consistent with it. In this, the insights from information processing have most to offer for they capture the best insights from previous research but make it available in ways that can be translated into practical action.

This leads on to a consideration of how quality might be assessed, the theme of the next chapter.

## **Chapter 5**

### **Measuring Quality**

#### **5.1 Introduction**

This chapter discusses how quality assurance in education has been measured in a selection of different countries including Bahrain. This evaluation will be considered from two main points of view:

- (1) What did the agents of quality assurance do to ensure the best quality of education for their citizens;
- (2) What are the challenges they faced while implementing quality assurance measures in schools.

The focus here is on quality assurance in schools (ages 12-18).

#### **5.2 Quality Assurance in Asia**

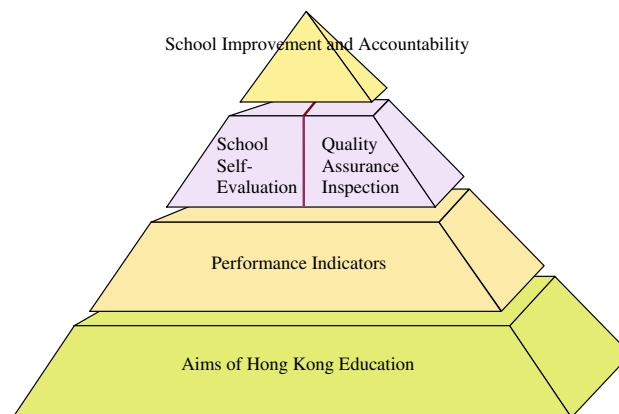
In this section, the quality assurance procedures of a number of countries are considered. The countries are chosen on the basis of having developed and published quality assurance systems which reflect different areas of the world and which have proved to be influential.

##### **5.2.1 Quality Assurance in Hong Kong**

In her study, Mok (2007) analysed the quality assurance and school monitoring systems in Hong Kong with regard to globalisation, and advancements in information technology in the 21st century. It appears that the government in Hong Kong, when involved in measuring the quality of school education, is no longer the only responsible agent. In fact, individual and neighboring schools, parents, students, and the community have also become active agents with the government to ensure the provision of the best

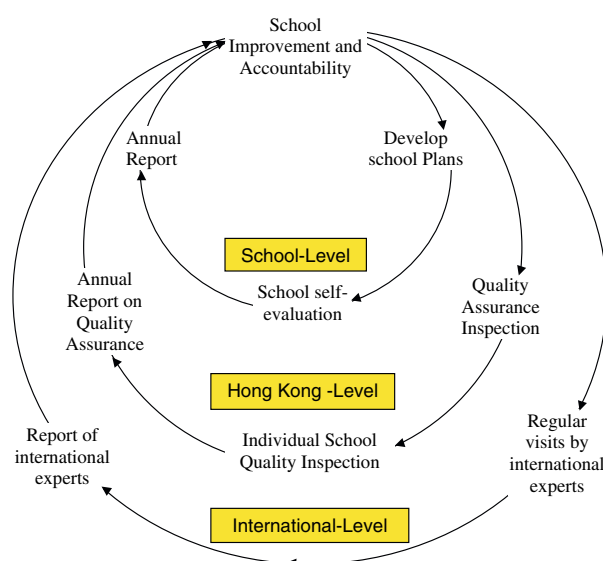


schooling to the learners. It is important at this stage to introduce the different stages upon which quality assurance is measured in Hong Kong.



**Figure 5.1 Self evaluation and external school review framework**  
(Source: Education and Manpower Bureau, Hong Kong SAR, 2004)

Indeed, as shown in figure 5.1, the quality assurance framework is shaped by the the aims set for the Hong Kong education which support a range of quality performance indicators that involve two parallel processes of self-evaluation and external-review of schools. Ongoing school improvement and accountability are the ultimate goals of the framework. The accountability framework of quality assurance process, as displayed below in the figure, relies on the explicit involvement of local and international experts.



**Figure. 5.2 Multi level school self evaluation and external school review processes**  
(Source: Education and Man-power Bureau (2004),  
Hong Kong SAR; [www.emb.gov.hk](http://www.emb.gov.hk)) from Mok (2007; p:191)

Mok's analysis identified six key strategies used to ensure quality education in Hong Kong. It is important to state them all as follows:

- “(a) *Investment of huge amount of resources to education to support initiatives and to promote quality;*
- (b) *Capacity building of drivers and leaders for education reform through teacher education and mandatory principal development;*
- (c) *The development of multiple indicators on academic value-added and on affective and social domains in order to support schools for self-monitoring and external school review by the government;*
- (d) *Initiate large scale assessment reform firstly to refocus the traditionally single-purpose public examinations from assessment of learning to a system of multiple-purpose assessment, namely, assessment for learning, selection, accountability, and articulation. Secondly, the reform attempts to move away from traditional norm reference assessment to a new standards reference assessment using rubrics and standards;*
- (e) *Instigate major curriculum reform to move away conceptually and strategically from focusing on content to putting equal emphasis on content, learning to learn, and generic skills;*
- (f) *Using international assessments and world class standards as frame of reference for excellence and aspiring to be the education hub in the Asia Pacific Region.”*

(Mok, 2007, p: 201).

There is much in this description that is simply based on assertion. For example, the word ‘*reform*’ is used and this carries overtones of improvement. However, there is no evidence that ‘*educational reform*’ as defined by politicians has improved education. Phrases like ‘*capacity building*’, ‘*value-added*’, ‘*self-monitoring*’, ‘*assessment for learning*’, ‘*generic skills*’ all sound good but there is lack of evidence on either their validity and how they can be achieved. Indeed, any concept of ‘*assessment standards*’ and the use of ‘*international assessments and world class standards*’ assumes that ‘*standards*’ can be defined and can be measured across widely different educational cultures in the world.

At the outset, a great deal of effort needs to be invested in re-defining and re-conceptualizing education quality and in choosing the appropriate ways to achieve that quality. Heifetz and Linsky (2002) note that professionals will undoubtedly feel the pressure and load in implementing them as the aspirations driven by these changes and the challenges they created are incompatible with reality and require adaptive learning that does not exist.

What is interesting here is that Hong Kong is not the only country having to go through the difficult demands of this so-called educational '*reform*'. Many other countries in the area or worldwide are having to surmount the same hurdles and at the same pace. Based on various research, Cheng (2006) suggests that Hong Kong schooling suffers from the repetitive change syndrome, which, in Abrahamson's (2004) "*words, means initiative overload, change related chaos, and employee cynicism*". Indeed from 2000 to 2006, Hong Kong schools had gone through major curriculum reform, assessment reform, education structural reform, change in medium of instruction, mandatory teacher continuous professional development, student admission system at secondary one level, IT reform, and integration of students with special needs to the mainstream (Cheng 2006). These educational reforms in such a short period of time had a back effect, triggering fear and unrest amongst practitioners. The bad effect of such burden has led several teachers to commit suicide which ignited a protest march of over 10,000 people (mostly teachers and parents) against the education reforms in January 2006. Consequently, the government softened its requirements and the launch of school-based assessment has been delayed for several years (Mok, 2007). All this questions whether '*reform*' has brought improvement.

### 5.2.2 Quality Assurance in Singapore

Like in Hong Kong, Ng (2007) argues that quality assurance in education in Singapore has always been of a great concern to the government. The most comprehensive quality management system currently in use is the School Excellence Model (SEM) which was implemented from 2000. It is a self-assessment model for schools and it stems from various quality models used by business organisations. The main goals of this system are to provide:

*“A means,*

- (1) To objectively identify and measure the schools’ strengths and areas for improvement;*
- (2) To allow benchmarking against similar schools;*
- (3) To stimulate improvement activities that can positively impact on the overall quality of the school and ultimately the quality of the education system”*

(Ng, 2007, p: 241).

The SEM consists of nine quality criteria against which schools are being assessed. These are extracted from the guide of Ministry of Education (2000) and are stated as follows: (1) School Leadership, (2) Strategic Planning, (3) Staff Management, (4) Resources, (5) Student-Focused Processes, (6) Administrative and Operational Results, (7) Staff Results, (8) Partnership and Society Results, (9) Key Performance Results.

For each of the above quality criteria, assessment in the SEM requires evidence of (Ng, 2007; P: 241-242)

- “(1) A sound and integrated approach for systematic, continuous improvement for all criteria of quality defined by the model;*
- (2) A systematic deployment of the approach and the degree of implementation;*
- (3) A regular assessment and review of the approaches and their deployment based on monitoring and analysis of the results achieved and on-going activities;*
- (4) An identification, prioritisation, planning and implementation of improvement activities;*
- (5) A set of appropriate and challenging performance targets;*
- (6) A continuous improvement of results over three to five years;*

- (7) *A benchmarking of performance against comparable schools;*
- (8) *An identification of the causes of good or bad results”*

The model assumes that what is appropriate for business organisations is appropriate for education. This is highly flawed in that, unlike business organisations, the ‘*product*’ and its quality from education cannot be defined in neat objective terms. Indeed, the use of terms like, ‘*performance against comparable schools*’ and ‘*an identification of the causes of good or bad results*’ assumes that performance in schools can be measured in some kind of objective way.

As mentioned earlier by Ng (2007), the SEM is a self-assessment system which is supposed to assist school leaders in the improvement of their educational institutions. The results of school self-assessment are also validated by an external team from MoE once each 5 years using the same criteria.

Ng (2007) also describes the Masterplan of Awards for schools which is closely linked to the SEM. It consists of three levels; the first deals with the achievement Awards given annually to schools for their achievements, the second comprises the Best Practices Award which recognises schools for their higher scores in the ‘*enablers*’ category, and the third is the Sustained Achievement Award which is given to schools that sustained good scores in the ‘*Results*’ category. Added to these awards, there are at the top of the awards the School Excellence Award and the Singapore Quality Award.

It is interesting at this stage to present the challenges that the Singaporean quality assurance system in education creates to stakeholders. These issues are stated in the following points:

- (1) Inherent tension in a centralised decentralised approach. Indeed there is a palpable struggle between empowering schools and teachers and meeting the demands of quality assurance system.
- (2) Marketisation and competition. With quality assurance in place, schools have to operate like corporate enterprises where they need to compete for resources, achievement and

reputation in the local and even in the global educational marketplace. The acute need to score well and be eligible to reputable awards may have side-effects like creating schools which are more interested in competing for the award than in providing holistic quality education for their clients. Indeed, there are “...incidents of schools dropping certain sports from their co-curricula activity list in order to focus on their niche areas, areas of strength where they were more likely to reap results and win awards”. (Ho and Almenoar, 2004, in Ng, 2007, p: 244).

- (3) Award versus innovation. Theoretically, awards are supposed to promote quality and celebrate excellence. In competitive environment like education, awards are also very important marketing tools used to convince ‘customers’ of the quality of the educational provision. The need to win awards appears to be the driving force of most schools which tend to avoid taking on board innovation and diversity as they are not recognised by the existing quality assurance system.
- (4) Sign posts versus performance indicators. Emphasis on performance indicators by schools is marked at the expense of signposts that promote cutting edge innovation.
- (5) School leadership stresses the need to train school leaders who are reflective, systems thinkers, champions of change and leaders of the future active members of society. If these educators are not careful, they might be solely working to satisfy the requirements of the system which will distract them from taking into account the softer and finer aspects of their noble mission.

### 5.2.3 Quality Assurance in Japan

Knipprah and Arimoto (2007) described (1) how quality in education has been ensured in Japan, (2) what changes in the assurance of quality are brought forth by the reform measures, and (3) the reaction of scholars towards these measures.

On international assessment level, Japan has shown since decades that Japanese students always score high in Mathematics and Science tests. However, there is considerable doubt about the validity of such tests as a measure of performance (Goldstein, 2004). Consequently many scholars, journalists and policy officials worldwide were keen to identify the factors within the Japanese educational system that are behind this success. They found that preoccupation with academic achievement due to entrance exams was bringing about high performances. They also found that,

although students had high scores in Mathematics and Science, they seriously lacked individuality and creativity (Roesgaard, 1998; Schoppa, 1991).

Thus, Japan was producing people who are maladjusted to new economic needs and globalization. Also in the early 90's, schools in Japan increasingly started to have a sense of educational crisis in terms of violence and bullying because of a lack of proper school moral education, and stress due to academic competition, and uniformity (and rigidity) of the system (Fugita, 1997).

The above-mentioned problems led the Japanese National Council on Educational Reform (NCER) to introduce educational '*reforms*'. Its proposals in this matter emphasized (1) Individuality, (2) Life-long Learning, (3) Globalization and the (4) Information-based society (Cave, 2001 and Hood, 2001). These recommendations, backed by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), have been very influential in setting an agenda for subsequent policy (Cave, 2001).

Mok *et al.* (2003) argues that quality education in Japan can be measured and assured at three levels.

The ***first level***: Input consists of prescribing standards of education. In this phase, two main domains are targeted namely: curriculum guidelines and teacher training professionalism. In the former, curriculum standards are prescribed in courses of study decided on the basis of recommendations from curriculum council consisting of educators and academics. It is marked by decentralization where schools are provided more opportunities for flexibility in their curriculum. Cross-subject learning is also introduced to enable schools to conduct educational activities that enhance creative skills. In the latter, quality of teachers is aimed through '*reform*' in teacher education and certification (Arimoto, 1995).

The ***second level***: Process deals with the monitoring and implementation of the national standards. It used to be operated at the national and local levels by the hands of administrators, bureaucrats and researchers. Then, around a decade ago, it embraced opportunities for external review of educational institutions by parents and community members as well.

The ***third level***: Output deals with checking whether the desired results are generated.

Achievement in the Japanese educational system is assured through:

- “(1) *Assessment of ‘the state of learning’, which covers the process of learning as well as the outcomes of the individual student;*
- (2) *Assessment of ‘the state of learning’ and the implemented curriculum at the school level; and*
- (3) *Assessment of the ‘the state of learning’ at the regional and national level.”*

(Kyoiku Katei Shingikai, 2000).

The curriculum council emphasises the importance of assessing not only academic performance but other aspects of student life as well including motivation to study, willingness to participate in activities and behavioural aspects relevant to emotional education and new desired educational outcomes. It also advises multiple methods of assessment in addition to paper tests like student’s art work, reports etc.

It is argued that despite the Japanese Ministry of education effort to move toward deregulation, the ministry's measures and reform rhetoric are mismatched (Knipprah and Arimoto, 2007). Indeed according to Lincicome (1993, p: 129), the educational changes put forward by the NCER aimed “*to imbue a new generation with the attributes of cosmopolitarism, while instilling them with culturally conservative and highly nationalistic consciousness*”. It is interesting to note as well Kudomi *et al.* (1999) observation that there are three directions in the field of education reform in Japan: (1) state bureaucratic control; (2) deregulation and marketization and (3) participation and local or school autonomy, and these three directions conflict with each other. As far as



school councils, Ozawa *et al.* (2000) argued that there are many flaws including the fact that the community and parents are not necessarily provided with the opportunity to express their opinions and to participate actively in school education, and in decision-making.

Last but not least, it is worth to mention here that, at the end of Knipprah and Arimoto's (2007) paper, questions with regard to the impact of quality assurance measurements on educational practice were highlighted. They argued that a great deal of research in this area needs to be done to answer these questions.

### 5.3 Quality Assurance in Bahrain

Quality assurance in Bahrain starts from the vision and mission stated by the Quality Assurance Authority of Education and Training (QAAET). In the vision, all stakeholders are, '*To be partners in developing a world-class education system in Bahrain*' (p:7). In its mission, the QAAET (2011, p: 7) stated that,

*"As an independent entity, we assure the quality of education and training in Bahrain by:*

- Reviewing public and private schools, vocational training and higher education institutions, both for accountability and improvement purposes;*
- Developing and implementing a national examination system for schools;*
- Publishing reports of findings;*
- Advancing Bahrain's reputation as a leader in quality assurance in education regionally and internationally".*

Discussing QAAET's mission here will be dealt with through three points: Schools Review; After School Reviews; Recommendations for improvement.

The key documents are presented in appendix (5).

### 5.3.1 Schools Review

Schools review in Bahrain is a relatively recent phenomenon, starting only in 2008. During the academic year 2010 – 2011, the school review unit carried out reviews in 18 schools in line with the practice established in the previous two years of school reviews, Depending largely on the school size, this practice involves teams, typically consisting of five to eight reviewers. Their duty is to spend three days in school (1) observing teaching delivery, (2) analysing students' performance, (3) meeting with key school leaders, parents and students, and (4) scrutinising students' written work. The review framework structures the evaluation of school effectiveness in terms of learning outcomes and educational provision (QAAET, 2011). These are:

- *Students' academic achievements and their progress in personal development,*
- *Quality of the school's provision in terms of teaching and learning,*
- *Curriculum delivery and enrichment,*
- *Quality of support and guidance, and*
- *Quality of the school leadership and management.*

The reviewers award the schools a grade for overall effectiveness and a grade on their capacity to improve. These grades are awarded on a four point scale:

Outstanding 1	Good 2	Satisfactory 3	Inadequate 4
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Although the ratings vary from year to year, most schools are rated as 2 or 3. Schools, which have been judged to be '*outstanding*', are encouraged to strive for more improvement by sharing their best practice within the school and amongst other schools.

Those which receive an overall grade of '*inadequate*', are subject to a monitoring procedure by the Schools Review Unit (SRU). Their progress towards meeting the recommendations in the review report is assessed by a monitoring team which visits the school between six months to a year after the review (QAAET, 2011)


### 5.3.2 After the Schools Review

According to QAAET (2011), after the schools review, schools are asked to complete an action plan to address the areas for improvement identified in the review report. Schools are given six weeks after the publication of the review report to formulate an action plan and submit it to the Ministry of Education for scrutiny. The Ministry, in turn, forwards the action plan to the school review unit for comments. In the case of schools where there is an overall grade of ‘*inadequate*’, the school review unit undertakes monitoring visits within six months to a year to assess schools’ progress towards addressing those areas which were identified as being in need of improvement. This leads us to the consider the following section.






### 5.3.3 Recommendations

School improvement requires planning and action. Planning should be based on an accurate evaluation of current performance and describe priorities and actions set against measurable steps so that progress can be identified and tracked. While the quality of leadership by the principal and senior team is probably the most single important factor in driving school improvement, it is the implementation of planned actions by the whole team across the school community which brings real change and development. In cases where schools are seriously inadequate, a more radical approach to intervention, strategic planning, implementation and direct action is required.

With regard to the QAAET (2011) report, there are several specific areas for improvement:

-  “Schools should take firm action on the specific recommendations made in the SRU report and be able to demonstrate progress made on each recommendation

within six months of the publication of the report and certainly by the time of the second review of the school.

-  A realistic approach to self-evaluation is required. This must be based upon firm information, evidence and careful reflection and use of the criteria in the Review Framework and Guidance. For example, where a self-evaluation form (SEF) grades the provision as ‘good’, the information and evidence to support that statement should be clearly made and matched against the appropriate criteria in the framework.
-  The assessment of students’ achievement needs to be more accurate and make more use of external benchmarking. Indeed, school reviews continue to report that the standards witnessed in classrooms do not correspond to the standards reported in Ministry of Education (MoE) and school assessments. The school-based element of the overall assessment grade should be substantiated with accurate and timely evidence of student performance to go alongside the MoE and school examination results. Valid assessments that are shared with students should inform them about their progress, strengths and areas for improvement.
-  The quality of teaching and learning should be improved by increasing the range of strategies used in order to provide appropriate levels of challenge for students of all abilities in lessons and in their independent learning.
-  The curriculum should be implemented in imaginative and practical ways, with a wide range of extra-curricular activities to make it relevant to the students’ levels of interests and needs and with opportunities for the students to make links between subjects. In too many schools, the curriculum is delivered in unchallenging ways directly from textbooks. There needs to be less dependency on textbooks as the sole teaching and learning resource.
-  Improvement plans should be a shared responsibility indicating duties for named post-holders, evidential success criteria and realistic timelines in order to provide progression in the drive for improvement actions to continue and raise the standard of students’ outcomes through the normal turbulence of school management.”

The weakness of the system in Bahrain is that it assumes that outsiders to the school can describe operationally the characteristics that reveal quality. There is no shared ownership with the teachers who have to deliver the service. It also assumes that 3 days of visits can reveal the quality or otherwise of educational provision. This kind of approach has been heavily criticised by Danielson (2008). Indeed, as soon as an outsider enters the classroom, the dynamics of the classroom are changed, making such observation of limited value. Perhaps the most worrying feature is that evaluation of schools is largely undertaken by those with little or no teaching experience. This is likely to lead to unrealistic expectations and a breakdown in confidence among experienced teaching staff and may be the source of observed disquiet.

Finally, no evidence has been produced that all the effort actually generates any improvement in the education of the learners. Indeed, looking at the criteria which have been summarized in the last chapter about features of quality of learning, none of these seems to figure in the performance indicators used.

#### **5.4 Quality Assurance in Finland**

Perhaps the situation in Finland can be best described by referring to a small part of a report of a meeting, in 2012, in the Finnish Embassy in London:

*'Whilst it has been widely noted that the Finns have seen positive results from measures such as children starting school at age seven and no national inspection of schools or league tables, the event's first speaker from the University of Helsinki, attributed Finland's success to their educational approach. She highlighted the fact that Finnish culture regards education as a source of hope for a better society and life. This requires the same educational opportunities for every child, hence a completely comprehensive system. At the forefront of this are excellent quality teachers, who are trained to at least Masters Level, with only ten per cent of those that apply being accepted onto the teacher training program. Although teachers are not paid especially highly, prestige and status attracts the best candidates into the profession, who are then given the freedom and trust they deserve.'*

There are major important messages for quality assurance in this approach and these can be summarised:

- ☑ No external school visits, reports and criticisms;
- ☑ Teachers are supported, trusted and affirmed as professionals;
- ☑ Teachers are highly trained and given the freedom to move to high quality;
- ☑ Society, as a whole, shows the way it values education in practical terms.

It is an interesting observation that Finland has often been applauded for the quality of its educational provision. However, there is no competition within the system, no inspection system and few of the features of quality assurance procedures used in other countries. Implicitly, this suggests that the source of quality lies outside any attempt at quality assurance.

## 5.5 Quality Assurance in Scotland

The educational structure in Scotland is based on a continental European pattern unlike England, and its practice is much older than those in the rest of the United Kingdom. This section discusses quality assurance in Scotland from three time sequences: up to 1980; from 1980 to 2000; from 2000. About 95% of secondary aged children (12-18) between 12-18 years attend state secondary schools which are all comprehensive. Much of the following summary was derived from an interview with an experienced headteacher who also had acted as a chair of headteachers.

There is a long history of egalitarian traditions where all children had equal opportunities to do well. Also, there was a long established examination system which started in the 19<sup>th</sup> century, much of which remains unaltered and highly successful. The Higher Education system, as well, is long established and follows the 15<sup>th</sup> century European model. There is little academic-vocational divide in the curriculum, and there

is no arts-science divide in the curriculum. Schools are funded by central government but run by local government. Up to 1980, the schools inspectorate visited schools and produced confidential reports.

From 1980, the London government imposed on the Scottish educational system a policy that strongly emphasized examination results as indicators of good schools and demanded that school examination results were published. These were then compared in the media, which failed to understand the real factors that strongly influenced examination performance. School inspections reports were published, the schools having no right to challenge these. Finally, a structure of School Boards was set up. Boards gave parents considerable powers although these were rarely used.

These new regulations led to an increase level of stress in schools with no evidence of improvements, signs of curriculum distortion and spoon-feeding of learners to gain better examination results, a complete denial of different catchment areas during the process of comparing school examination results, little more than unhelpful interference of parents in the affairs of their children education.

From 2000, the Scottish Parliament reduced some powers of the inspectorate but they left reports to be published and unchallenged. They also stopped publishing the examination results. However, Local Authorities, seeing themselves as under pressure in their management of the schools very often set up their own inspection procedures. They used examination results to compare schools and as mechanisms to criticise headteachers.

The Scottish Parliament set up a new curriculum philosophy (Curriculum for Excellence, 2004) and this aimed to re-professionalise teachers. Despite much that was good, the new approach was hindered up by poor quality executive leadership at national level. Indeed, there is no evidence of improvements in a system which has

always had a good reputation. There is much anecdotal evidence of some ‘good’ head teachers leaving post in frustration. Indeed, at least one head teacher suicide was reported as a direct result of inspection procedures (Seith, 2009).

Perhaps, Humes (2012) captures it well when he states,

*‘Staff are much more likely to show commitment and gain job satisfaction if they are treated with respect, listened to when changes are proposed, given support when under pressure, and accountable to managers who lead by example rather than exhortation. Sadly, however, in a culture which prefers spin and celebrity, common sense is likely to have little appeal.’*

Similarly, the work of Sir Kenneth Robinson (*‘Out of Mind’*) reveals the effect of the league table culture in both England and the US. He found in the US that there was no evidence of any quality improvement while it led to a demoralised teaching force.

## **5.6 Quality Assurance in Chile**

This section will focus on the issue of school quality assurance and improvement in the Chilean educational system. In their very interesting study, Ahumada et al. (2012) proposed the need for closer collaboration between different levels (national, municipal and schools) of the school system as well as between school stakeholders including principals, students, teachers and parents in order to develop internal and system capacity for assuring and improving the Chilean educational quality.

Since the 1980s, Chilean provision of educational services have been operated through a market-driven model in which the government’s role has been to subsidise demand as parents “choose” among three different types of schools:

<i>Municipal schools:</i>	administered by the country’s municipal governments and are totally financed through a per-pupil voucher system based on student attendance.
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*Private schools:* financed through the same voucher system and, in most cases, charging parents an additional fee.

*Private fee-paying schools:* Fully funded by parents.

This highly stratified educational system led the Organisation for Economic Cooperation and Development (OECD, 2004, p: 255) to state in their report that “*The rules of the game are different – and unjustly so – for municipal and private schools. Private schools can both select and expel. Municipal schools – with the exception of the few prestigious ones that are in high demand – are obliged to accept all students asking for access. Under these circumstances, results can be expected to differ in favour of private subsidised schools.*”

Consequently, it is no surprise that McEwan (2001) and Raczynski and Muñoz (2007) found that Chilean students’ performance in national examinations is directly related to their socio-economical status and the type of school they attend. Therefore, requirements for improving quality and equity in the Chilean school system have been among the priorities of the policy agenda for the last twenty years, but with few positive results so far (Donoso and Donoso, 2009; Bellei, Contreras, and Valenzuela, 2008; Weinstein and Muñoz, 2009).

Indeed, in an effort to address this situation, the Chilean educational system is presently going through deep transformation thanks to the new legal frameworks which, according to Weinstein and Muñoz (2009), aim to modify the structure of the school system and ensure a high quality and equitable school system for all students. As argued by Ahumada *et al.* (2012, p:185): “*Quality without equity becomes a mere compliance with standards without consideration of the contextual and local aspects*”. The relationship between quality and equity in any system of quality assurance is worth considering as “*Equity*” refers to fairness in access to educational opportunities so that students’ outcomes do not depend on their social-cultural characteristics. Though these

reforms have influenced school education on issues such as finance, accountability and governance of schools and local administrators (Brunner and Peña, 2007), they have also safeguarded the government's role of control and assessment of curricular issues (Muñoz and Vanni, 2008).

The System for Quality Assurance of School Management (SACGE) in Chile was implemented between 2003 and 2007 and promoted a cycle of continuous improvement based on four phases: institutional self-evaluation, external review, school improvement plan and public account (MINEDUC, 2005).

The purpose of the institutional self-evaluation phase is to produce base-line information about the school's management process and results in order to establish the quality of its daily educational practices. It also seeks to identify those areas that could be improved (MINEDUC, 2005). As to the second phase, external review, it intended to validate the institutional self-evaluation. For the Chilean MoE, this phase should be providing objective information to the school about their self-evaluation, as a way of contributing to their improvement process (MINEDUC, 2005). This external evaluation was managed by an external panel (a group of professionals) who were not part of the school in question, but they were related to it in their capacity as ministry supervisors or municipal officers. With regard to the third phase: developing and implementing an Improvement Plan, it consists of designing, implementing and evaluating actions that are meant to generate positive changes in the school's management already in place. Finally, with the Public Accountability phase, the principals are asked to share with the community the schools' outcomes and progress on matters related to the quality of teaching, learning and management processes. The major aims of this phase are to promote accountability, seek transparency and facilitate access to the results and management processes to the school community (Marks and Nance, 2007). It is

important to mention that accountability, in this context, also means taking responsibility for appropriately representing the rights and needs of the community.

The analysis of the impact of SACGE by Ahumada et al. (2009) showed that, although all schools evidenced important changes in their practices, not all schools managed to assure quality and develop a culture of continuous improvement. The results also revealed several difficulties in the implementation of SACGE such as: inadequate training, contradictory information and inconsistent support from local administrators, which in turn hindered the possibility for schools and their school leaders to engage in the improvement process.

The quality model underpinning SACGE as an assurance system acknowledges values, encourages the diversity of schools and assumes that the implementation of each phase ought to consider the school's culture and history (MINEDUC, 2005). By this, schools are given the autonomy to identify and define the appropriate management practices for their context and needs. Thus, SACGE invites schools and those in charge of managing schools to take full responsibility for the results that the proposed improvement plan aims for and is capable of achieving.

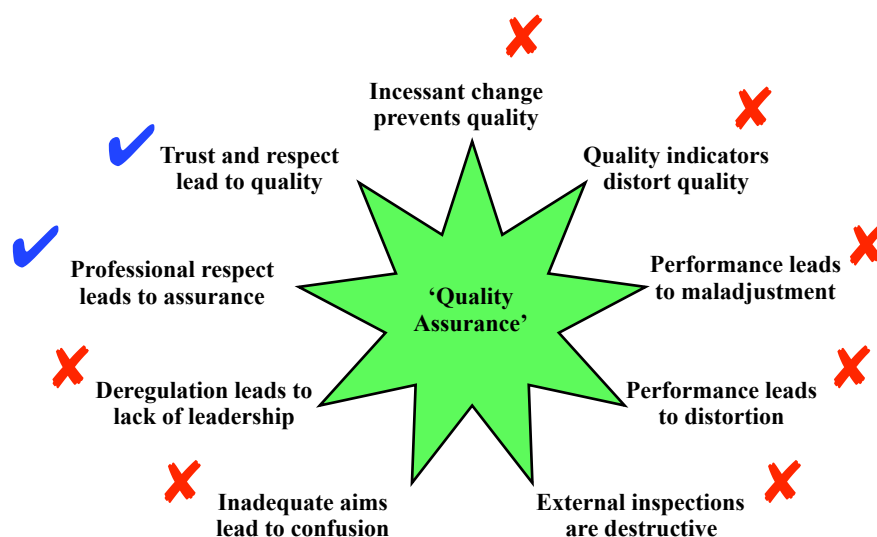
Research evidence on institutional self-evaluation (Navarro and Jiménez, 2005; Soto, 2006) indicates that the process of self-evaluation raises the awareness of the existing leadership style in the organization, the characteristics of the organizational culture and the degree of satisfaction of teachers and school leaders. In a study about the functioning of schools' management team during the implementation of SACGE in ten primary and secondary public municipal schools conducted by Ahumada et al. (2008), there was evidence of four factors that accounted for a good teamwork: trust, sensemaking, efficiency and effectiveness, and ineffectiveness. Trust appears to be the key factor in determining a well-functioning team.

Muijs et al. (2004) found that the usefulness of external evaluation is tightly linked to how schools assume this instance to generate a learning process, and to ensure commitment and participation of all of the agents of the school community.

It is an interesting observation that the issues of equity feature highly also in the Scottish and Finnish systems while the lack of equity identified in the earlier Chilean system is now a major feature of the English educational system now seen as under stress. However, the most important feature is that trust has been identified as the key feature for success in terms of quality: trust across all stakeholders.

## 5.7 Conclusion

From the discussion above, though each country has its own culture, hence system in ensuring quality of education, we can still draw the following concluding points that we believe would be best presented as follows (figure 5.3). In this diagram, features of ‘quality assurance’ that seem unhelpful are shown with a cross while good features are marked with a tick.



**Figure 5.3 Concluding points of quality assurance measurements in education**

Indeed, to ensure quality in education, it is necessary to make sure that the aims and objectives of education are very well formulated and adequately aligned to students' performance and achievement. Quality indicators should also be clearly stated, reasonable and understood by teachers, principals and evaluators. School principals and their management teams need to work hand in hand with all schools' stakeholders to develop a learning-oriented organizational culture that is committed to a continuous improvement of its processes and outcomes. This can be perceived as hard work but it can certainly be facilitated to the extent that there is a shared understanding of where the school stands on the indicators for educational quality and the capacities that need to be developed in order to improve. Incessant change in education to ensure quality has been proven to be destructive and too stressful to handle.

In looking at the patterns of quality assurance in a selection of countries in the world, the evidence suggests that the approaches adopted in Finland hold useful prospects as a model for Bahrain. These might be coupled to the key feature of Chile where all teachers are seen as evaluators and to be evaluated (after appropriate shared training). The latter approach immediately will tend to lead to shared agenda and a shared perception of what constitutes quality. The Finnish model stresses the professional trust given to the teachers with the expectation that teachers will respond to the trust. Indeed, this underpins the philosophy behind '*Curriculum for Excellence*' in Scotland where the overt aims was to re-professionalise teachers and release them to professional freedom and responsibility. The outcomes from Finland are encouraging in that regard.

## Chapter 6

### Measuring Attitudes

#### 6.1 Introduction

In order to explore the perceptions of some of the key stake holders in secondary education in Bahrain, it is important to be able to make some kind of measurement of how they see quality and, in the case of the school students, how they see their experiences in learning. This moves into the field of attitudes, opinions and perceptions.

Attitude measurement is a problem of a great importance for attitude research. Being defined as a latent construct, it is obvious that any knowledge about attitude can only be constructed by inference from the measured responses. In other words, the measurement of attitudes is an area of considerable difficulty.

In this chapter, there is a general review of attitude development. This starts by exploring what an attitude is and considering definitions for attitudes. The way attitudes form and develop as well as methods for measuring attitudes are outlined. Also the importance of attitudes and the place of attitudes in education are discussed. Finally, it seeks to offer an overview of the key developments in the field and to indicate how the approaches used in this study derive from the procedures of others.

One of the problems is to define what are meant by some of the key terms that are used. In this, the term '*attitude*' will be considered first before looking at some of the other terms.

## 6.2 Attitude definitions

The term “attitude” has been used in many ways, reflecting, in part, the problem when daily language vocabularies are employed in technical and scientific disciplines. There are numerous definitions in the literature and many attempts have been made to try to reach a consensus on the term. However, many psychologists have criticized definitions merely to add yet another definition. A survey of a number of these meanings is offered here.

In 1929, attitude was defined by Thurstone as “*the affect for or against a psychological object*”. After three years, Likert (1932) described the term as “*a certain range within which responses move*.” In 1935, Allport gave a definition that described an attitude as “*a mental and neural state of readiness to respond, organized through experience, exerting a directive and/ or dynamic influence on behaviour*.” This definition is still widely used. In 1946, Krech suggested that attitudes might be thought of as aspects of learning, since they are “*attempts at solutions*” while, in 1947, Doob argued that perspectives of learning are related to attitude development.

It has to be recognised that different contexts might entail different definitions for the term. Nonetheless, some kind of widely accepted definition is useful. Oppenheim (1992), building on Allport’s ideas, suggested that:

“... attitudes... [are]... *a state of readiness or predisposition to respond in a certain manner when confronted with certain stimuli... attitudes are reinforced by beliefs (the cognitive component), often attract strong feeling (the emotional component) which may lead to particular behavioural intents (the action tendency component)*”.

According to Ramsden (1998), Oppenheim’s definition is “*acceptable to most researchers*”. However, the term ‘attitude’ was also labelled as a “*concept with evaluative dimension*” (Rhine, 1958) and, later, Eagly and Chaiken (1993) incorporated this idea when they defined an attitude as “*a psychological tendency that is expressed by*

*evaluating a certain entity with some degree of favour or disfavour*". It has to be noted that knowledge about an attitude object will not necessarily mean that an attitude towards that object exists *unless* there is evaluative response relating to the object. Thus, for example, knowing about pollution does not necessarily imply that the person holds an attitude relating to pollution. However, if their knowledge also involves an evaluation of the implications of pollution, then attitudes will be present.

There is sometimes a confusion that attitudes can be equated in some way with the affective. The development of attitudes usually involves much more than just the affective. There may be a cognitive, affective or behavioural basis or any combination of the three. Emphasising the cognitive and affective, Katz and Sarnoff (1964) refer to a "*stable organization of cognitive and affective processes*" while, in 1971, Triandis described an attitude as "*an idea charged with emotions.*"

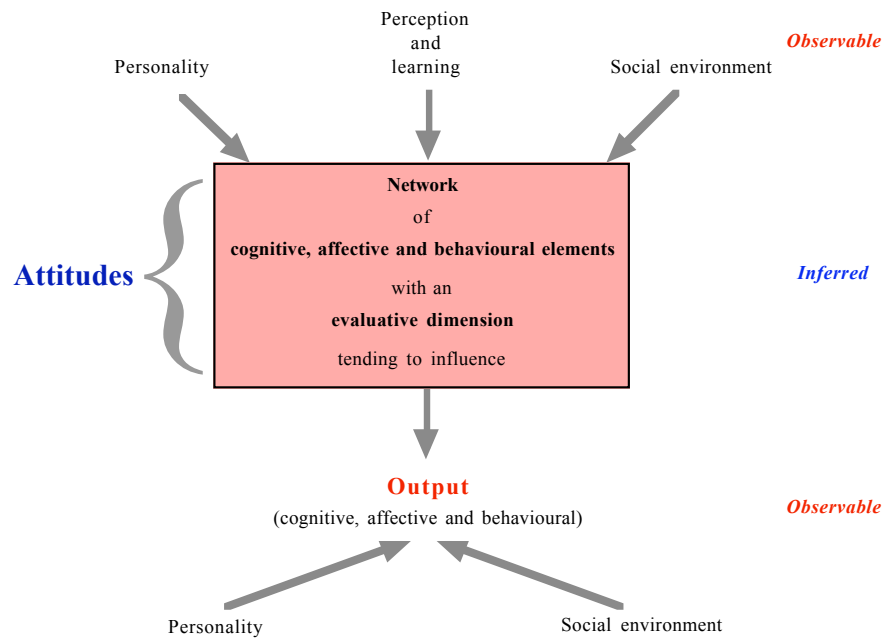
In 1964, Cook and Sellitz stated that attitudes do not control behaviour in an exact way: they pass "*along with other influences into the determination of a variety of behaviours.*" However, behaviour can also influence the development of attitudes while behaviour can be strongly influenced by held attitudes.

Bringing some of this together, Reid (1978) reviewed the research of that time and noted the three aspects:

- (6) *Cognitive*, in connection with knowledge and thinking about the attitude object.
- (7) *Affective*, connected with the attitude object.
- (8) *Behavioural*, including actions connected with the attitude object.

He went on to draw together the various ideas in the literature to offer a diagrammatic representation to illustrate what was generally understood in the psychological literature about the nature of attitudes. He stressed that attitudes must be inferred and that is important for all approaches to attitude measurement.





**Figure 6.1 A Model for an Attitude (Developed from Reid, 1978)**

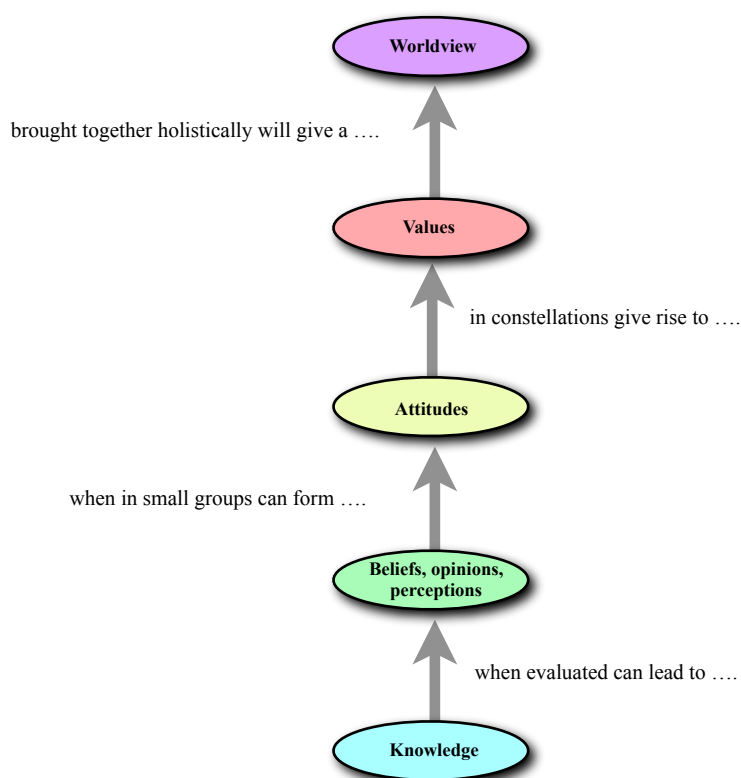
The diagram incorporates the factors of cognition within attitudes as well as readiness to respond to results. There is an implicit warning against erroneous deduction from behaviour patterns. Other factors, working alongside attitudes, can influence behaviour. Even though attitudes have a functional purpose, personality and social factors affect it (eg. limiting behaviour in a way that there is no apparent relation to real background attitudes).

Social psychology has developed much in the last quarter of the century (Eagly and Chaiken, 1993). The process of evaluating attitudes depends on feelings, knowledge, behaviour; the development of an attitude is one of the forms of expressions of that evaluation. This results in the modern understanding of attitudes in terms of evaluation which encompasses cognitive and affective elements as well as experience.

In 2003, Reid suggested that attitudes demonstrate our evaluation of anything. Our knowledge, feelings and behaviour may be the basis for attitudes which may affect our future behaviour. A target is an indispensable component of an attitude which may be directed towards something or someone. Attitudes are very complicated and can

influence learning strongly. This leads to the importance of attitudes in the whole learning process.

In the entire area of attitude research, several words are used frequently. In her review of the literature, Oraif (2007) suggested a hierarchy which offered some clarification of the terminology. Figure 6.2 is based on her analysis and illustrates the way the words are often used in the literature.



**Figure 6.2 An Attitude Hierarchy (developed from Oraif, 2007)**

In this study, the aim is to gain insights into the key perceptions of the students, their teachers and educational administrators. Overall, this will reflect their overall attitudes.

### 6.3 The importance of attitudes

It is important to recognise that attitudes will develop in learners whether it is the overt aim of the teacher or not. Therefore, it will be unhelpful to ignore attitudes while thinking of teaching and learning. In the context of a subject like chemistry, the teacher

may concentrate on the communication of chemistry ideas and concepts but the learner will still develop attitudes towards chemistry, topics in chemistry, ways of learning chemistry and even the teacher. This is all part of the natural process of making sense of experiences which involves evaluation.

If a student faces a difficulty in an area of study, this difficult experience may lead him to possess a perception which may result in an evaluation that may block the process of learning. Reid (2003) has suggested that attitude development helps people to:

- (1) *Understand themselves.*
- (2) *Understand the world around.*
- (3) *Understand relationships.*

It is normal to ask our students to understand the world intellectually: this is the basis of their study in many subject areas of the curriculum. It is well known that attitudes enable learners to accomplish their mission of assimilating the world if they can understand themselves.

Reid (2003) suggested that there are four broad areas in the context of teaching and learning:

- (1) *Attitudes towards subject being studied.*
- (2) *Attitudes towards study itself.*
- (3) *Attitudes towards the implications arising from themes being studied.*
- (4) *The so-called scientific attitudes.*

He illustrated these four areas. For example, much research has explored attitudes towards physics and the study of physics (mainly because of declining uptakes in the US and England). It is well known that a student's attitude towards a subject is one of the strongest indicators that determine whether a learner will continue to study a subject or not. Through understanding the way in which learner's attitudes towards physics develop, it will be clear what enabled him to choose physics as a field of study. Of

course, this may involve specific attitude areas: attitudes towards practical work, towards certain topics, towards tutors, towards textbooks.

Johnstone and Reid (1981) tested a hypothesis derived from a scrutiny of the social psychology literature which suggested that attitude development was mediated by mental interactions. Working with large samples over a long time period, they found that the hypothesis was upheld by the data obtained. In other words, for attitude development to take place, the learner has to interact mentally with the material under discussion, in this way being enabled to form evaluations and internalise an attitude position. These results are consistent with two very recent studies (Al-Shibli, 2003; Hussein, 2006).

While being involved in the subject of study, learners' attitudes continue to develop. For instance, when a chemistry learner knows about the chemical industry in the course, he/she will start to develop attitudes towards this chemical activity. When a student learns about space physics, his/her attitudes will start to develop on such related topics. Learning subjects of work-related topics will permit students to form attitudes towards these related ideas.

It is commonly known that students will form attitudes towards study and work. This may be specific to study a specific subject or may be more general. However, attitudes towards study may have very important influences on future study success.

The scientific attitude is very complex and may well be more cognitive than attitudinal nature. Reid (2006) has attempted an analysis of features of this process:

- “(1) *Directed Curiosity*: This involves a desire to know, understand, solve problems and obtain answers.
- (2) *Logical Methodology*: A knowledge of, and willingness to pursue, a logical and cyclical series of operations in satisfying directed curiosity. This relates to the raising and testing of hypotheses.

- (3) *Creative Ingenuity*: A willingness to build mental constructs or models, set up realistic hypothesis, Design suitable experimental situations, see beyond set ideas in order to grasp new or create new ideas.
- (4) *Objectivity*: A willingness to assess error, control variables, view results objectively, distinguish description from explanation.
- (5) *Integrity*: A willingness to avoid bias, consider details that may appear contradictory, consider implications of one's own work, cooperate and communicate with others, respect instruments and materials.” (Reid, 2006, pages 7-8)

From this, it is difficult to separate what is clearly attitudinal from that which is cognitive or based on learned skills, or, indeed, what is a function of personality.

Many researchers have worked on deep and surface learning, taking a qualitative approach. In 1999, Perry published very influential work based on years of careful observation and interview with university students. This resulted in making a framework for analysing learner's attitudes, divided into four areas:

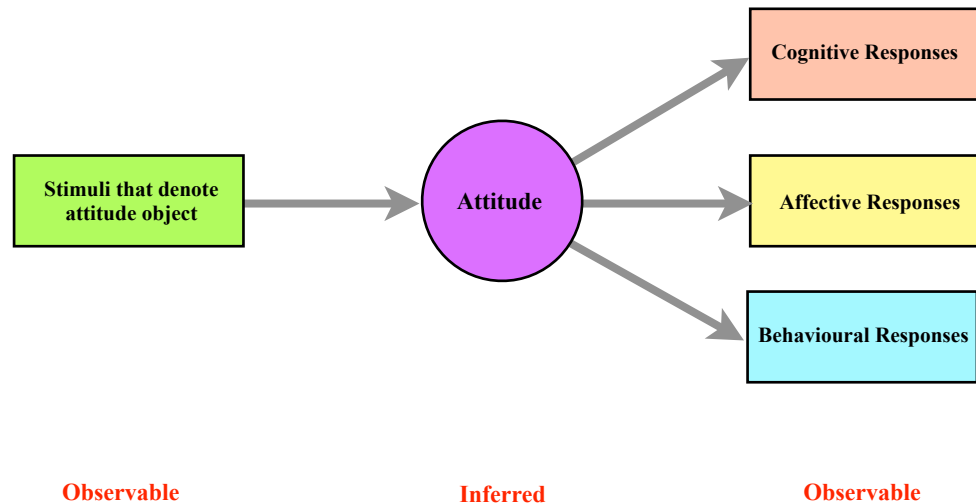
- (1) *Student's perceptions of the nature of knowledge.*
- (2) *Student's perceptions of the role of the lecturer in their learning.*
- (3) *Student's perceptions of their role in learning.*
- (4) *Student's perceptions of the nature and role of assessment.*

Perry's work has offered very useful insights into the ways university students see their studies but this approach has only occasionally been applied at school level (Al-Shibli, 2006).

However, the work on attitudes has depended on the ability to measure attitudes and this is an area of some controversy.

## 6.4 Measuring or investigating an attitude

A person is unable to measure attitudes directly because they are latent constructs. Being more like cognitive entities, psychologists identify the kind of responses observed under certain stimuli to some kind of mental state such as attitude.



**Figure 6.3 General way of attitude investigation (source: Eagly and Chaiken, 1993)**

On observing and assessing the response of people when placed under certain conditions, attitudes are formulated. The attitudes investigation must be defined carefully otherwise there is a danger that, “*attitudes are what attitude measuring devices actually measure.*” (Johnstone and Reid, 1981)

Some of the more prominent techniques for attitude measurement (Cook and Selltiz 1964) include:

- (a) *Questionnaires.*
- (b) *Observation of apparent behaviour.*
- (c) *Physiological tests.*
- (d) *Partially formed stimuli (like projective tests).*
- (e) *Performance of tasks.*

In the context of education, questionnaires and interviews are the most widely used approaches. Questionnaires are faster as it is easy to collect a large amount of information through their use while, with interviews, the information is often rich and

revealing, although it may be based on a small selected number of interviews. A person can use questionnaires to investigate matters found from exploratory interviews. Similarly, it is also possible to authenticate questionnaires by use of short interviews.

Even though all techniques have their role, Cook and Selltiz (1964) suggested that none is completely flawless and the researcher must not merely rely on one method in his/her research. In practice however, this is easier stated than done. In the words of Oppenheim (1992), a questionnaire was:

*“... an important instrument of research, a tool for data collection... it can be considered as set of questions arranged in a certain order and constructed according to specially selected rules. The questionnaire has a job to do: its function is measurement.”*

Questionnaires may include two kinds of questions:

- (a) The open-ended kind, where the respondent enjoys full discretion in writing down what she/he thinks. Being a simple one to ask, it may prove to be equally difficult to analyse.
- (b) The closed kind, where there are anticipated answers by the designer. These may be harder for a designer to form; however, they may be simpler to analyse.

In an ideal situation, questionnaires should consist of both types but this is not always possible. Some requirements need to be met when designing a questionnaire for attitude measurement:

- (a) The attitude object must be identified and the range of stimuli should be specified.
- (b) In attitude measurement, the validity and reliability of the questionnaires is important.

Attitude measures causes considerable uncertainty regarding reliability and validity. Reliability is the capability of a measuring instrument to give the same results at different times. Germann (1988) describes how most measures mentioned in literature on reliability concentrate on internal consistency. Possibly of some benefit in

psychological measurements investigating latent constructs, this is not so suitable in most educational measurement where the aim is for different items to give the learner an opportunity to demonstrate *different* skills or *different aspects* of attitudes. In fact, internal consistency may be undesirable here.

As far back as 1969, Heise noted how, on different occasions, whenever an attitude measure has been used with large equivalent samples, a very similar pattern of results is found. This suggests the high reliability that each attitude question has. Similar high measures of reliability have been noted by Reid (2006). Here, it was found that using large samples was important as well as employing well-presented questionnaires where care had been taken to enable respondents to answer honestly (there was no hidden agenda) generated very high levels of reliability (seen in terms of test-retest).

Validity is much more important and more difficult to assess. Validity looks at whether the questions are implemented as the designer planned: Do the outcomes of the questions reflect what the setter intended? Two approaches can be helpful. Interviews can be designed to check respondents' comprehension of the questions in the way intended. The other way is to consult teachers with relevant experience with the type of respondents concerned and ask them to comment critically on the likely understanding of the question. Oppenheim (1992) saw questionnaires as scaling techniques that could produce valid and reliable results provided that careful construction and pre-testing were followed. Scaling, however, is not made use of here.

## **6.5 Methods for designing the questions for questionnaires**

There was a tendency to use scaling methods in the developments in much of the twentieth century and scaling continues today. Therefore, the methods of Thurstone (1928), Likert (1932) and, to a lesser degree, Osgood (1967) are often used in a scaling



context. This is where the overall attitude is scored according to responses and some questions are then summed up. For instance, in the Likert method, a response of ‘*strongly agree*’ might yield 5 points, ‘*agree*’ 4, ‘*neutral*’ 3, ‘*disagree*’ 2, and ‘*strongly disagree*’ 1. The ‘*score*’ of a person is found by adding up the values obtained in the set of questions.

Several major shortcomings, however, exist here. One assumption is that an ‘*agree*’, for example, is worth twice a ‘*disagree*’. This is actually nonsensical as the two responses are different. Another assumption is that there exists a scale in each question which is linear with equidistance in meaning between the five responses: highly unlikely.

Very significant is the error produced by applying parametric statistics to the results of the distributions obtained which may often be skewed and very far from normal. Indeed, distributions on specific questions may demonstrate bimodality or be an inverse of a normal distribution where polarisation of views is marked.

It should also be noted that attributes such as attitudes are multidimensional. Thus, a ‘*score*’ can be obtained in an infinite number of ways and two individuals with the same ‘*score*’ may well hold very different attitudes. The scaling method, with its adding up of scores from individual questions loses very useful detail. Reid (2003) has discussed the issues relating to the shortcomings of this approach while, in a very recent book (Reid, 2011), the whole issue is explored in some detail. However, the question designs developed by Thurstone, Likert and Osgood can be used where the data is not handled using scaling methodologies and their approaches are now outlined briefly.

### ***Thurstone method***

Thurstone’s study was published in 1928 (“Attitudes can be Measured”). The importance of this was its contribution in breaking away from behaviorism when

applied to attitudes. However, his approach is awkward and is rarely used now. He did, nonetheless, open the doors of attitude measurement study.

### ***Likert Methods***

Inspired by Thurstone's work, Likert published his paper in 1932. In this, he described a more efficient means to use questionnaires in order to measure attitudes. For each question, the candidate is allowed to select one answer: 'strongly agree', 'agree', 'neutral', or 'disagree', 'strongly disagree' (sometimes: 'very strongly agree', 'strongly agree', 'agree', 'neutral', or; 'disagree', 'strongly disagree', 'very strongly disagree'). This was seen as a means to provide more accurate information about the respondent's level of agreement or disagreement with a statement. From that, it could draw out specific information about the attitude held.

The Likert method was originally organized to be used as a scale where a respondent's attitude is determined by the value of the total score obtained. Likert held that the total score would be reflective of the attitude towards a particular object. If to rate "strongly agree" with positive statements about an attitude object as five points and "strongly disagree" with the positive statements about an attitude object as one point, then the maximum possible score obtained will reflect the extremely positive attitude and the minimum score will reflect the extremely negative attitude.

An example illustrates the approach:

Think about your school studies in Arabic language  
Tick one box on each line to indicate your view.

	<i>strongly agree</i>	<i>agree</i>	<i>neutral</i>	<i>disagree</i>	<i>strongly disagree</i>
(a) It is essential to be able to write Arabic clearly and accurately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) Too much emphasis was placed on Arabic literature in my studies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) I find studying Arabic grammar difficult	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) My studies in Arabic did not help me to read more	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) The examinations system affects the development of my Arabic skill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) My studies in Arabic prepare me well for further study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) The time for each Arabic class is enough	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

This was taken from a study by Alhmali (2007). The responses here clearly have a relationship with the quality of the education for those Libyan school students as perceived by the students. Each statement represents a student evaluation of one aspect. Together, they paint a picture of the quality of their education in Arabic and may point to their attitude towards this area of their studies.

### ***Semantic Differential method***

This is also known as the Osgood method, because Charles Osgood (1967) designed it. Although not originally in the context of attitude measurement, it is now very popular among attitude researchers, because it is a reasonably reliable and valid method for attitude investigation and it has been reported by several researchers that it has a coefficient of reliability around 0.91 (probably internal consistency), and has high coefficient correlation of about 0.90 compared to the cumbersome Thurstone techniques (Hadden, 1981).

Heise (1969) has argued that, “*Osgood’s method is eminently suitable in terms of type of sample, administration, easy design, high reliability and validity when compared to other methods.*” According to what is stated regarding the advantage of this method, it is adopted in this research.

Furthermore, the advantage of this technique allows the respondent to express the evaluation with the minimum of words. Another benefit of the Osgood method is the high speed at which the responses can be completed (Reid, 1978). This technique was originally deployed as a seven point rating scale with bipolar word-pair placed at the opposite ends of a scale. An attitude could be estimated by observing the overall score obtained when using scaling techniques. For example, positive for positive adjective,

and negative for negative adjective, including zero for neutral ones, or from +3 to -3, including zero. However, scaling is not used here.

Again, an example illustrates the approach. This example is taken from Shah *et al.* (2007) where the student perceptions of their laboratory learning at school level was being considered.

What are your opinions about your school laboratory experiences in chemistry ?

Tick ONE box on each line.

Useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Useless
Not helpful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Helpful
Understandable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Not understandable
Satisfying	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Not satisfying
Boring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Interesting
Well organised	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Not well organised
The best part of chemistry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The worst part of chemistry
Not enjoyable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Enjoyable

This gave a picture of the quality of their experiences as seen by the students looking back on their time at school and reflects the way they evaluated what their learning.

## Interview

One method to measure attitudes is interviews. This may be one of two kinds, a spontaneous conversation, exploratory type, or designed questions, standardised type. Regarding validity, interviews are regarded as more useful than questionnaires for gathering and checking data from the latter.

Interviews have some advantages: they may help to minimise misunderstanding and imprecision in answering questions. Moreover, the researcher can see both the order of responses and gauge the emotion behind responses. The major disadvantage is the time taken by both researcher and respondent for interviews. This is in contrast to questionnaires, where many may be carried out in a comparatively shorter time. It is

also more difficult to summarise answers from interviews. Preconceived notions could also all too unwittingly be confirmed by interviews.

It is often useful to use a few interviews alongside a questionnaire completed by a large sample.

A brief summary of some of the key approaches is now given in table 6.1.

A Key Reference	Summary
Thurstone (1929)	Rating scale, using teams of judges, rarely used today but a useful development can be found in Bennett <i>et al</i> (2001)
Likert (1932)	Assumes equal intervals, versatile but traditional scoring method seriously flawed
Osgood <i>et al</i> (1947)	Assumes equal intervals, versatile but traditional scoring method seriously flawed, both ends of scale described but limits to extent of language
Reid (1978, 2003)	Rating and situational sets methods described: former very useful, latter difficult to set and score
Oppenheim (1992)	Interviews offer greater flexibility and, perhaps, more assured validity but summarising outcomes much more difficult

**Table 6.1 Key methods to assess attitudes**

In the study here, the approaches developed by Likert (1932), Osgood *et al.* (1947) and Reid (1978) will be employed as well as the use of interviews. However, the ways to handle the data obtained from the questionnaires are important.

Data from questionnaires and surveys are ordinal. Therefore, calculating means and standard deviations is not permissible. Scores in the items cannot be added up because ordinal numbers cannot be added legitimately. In addition, a ‘*score*’ in one item cannot be added to the ‘*score*’ in another unless there is evidence that the two items are measuring the same variable. The whole area of data handling has been discussed at length by Reid (2006, 2011). In the light of this, the faulty method of scaling will not be used to analyse the data in this study.

## **6.6 Attitude research in education and factors affecting attitudes**

There is a very large number of studies which have looked at attitudes towards science or specific science subjects. Because most have used scaling techniques, the outcomes have often lacked detail and useful insights. Many years ago, Schibeci (1984) reviewed much work available at that time. He expressed his surprise that it still was not clear what were the key variables which determined attitudes. This may well reflect the inadequate methodologies which were used.

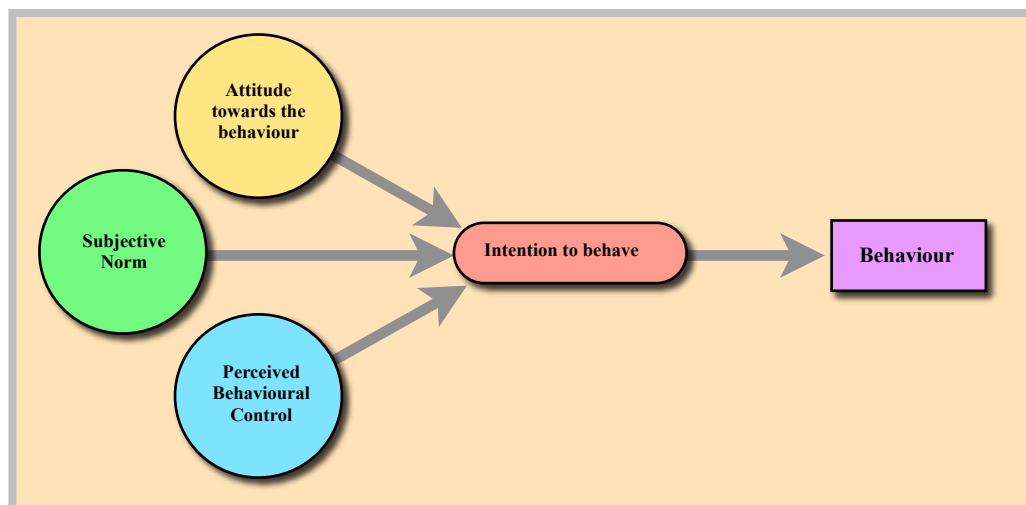
Weinberg (1995) mentions how early research indicated that boys had a more positive attitude than girls towards science. Barrington and Hendericks (1988), however, discussed waning interest with age. For reference, much research by teachers on attitudes towards science was looked at by Ramsden (1998).

Social attitudes relating to themes taught have rarely been studied, one of the few studies being carried out by Johnstone and Reid (1981). Recently, there are several studies looking at attitudes to science (eg Germann, 1988; Pell and Jarvis, 2001) and learning generally (eg. Al-Shibli, 2003; Mackenzie and Johnstone, 2003).

An interesting study on attitudes towards science and physics is that by Craig and Ayres (1988). Results showed that at primary stages of education, science did not motivate interest to study it at secondary education. Of both genders that had high interest in science at primary school, their achievement was quite low at the first year of secondary school. Interest decreased particularly in this year for girls, given that sometimes they were higher than the equivalent for boys at primary stages. The more recent study by Skryabina (Reid and Skryabina, 2002a) traced the development of attitudes to physics from age 10 to age 20 in Scotland while they also looked at the issue of gender (Reid and Skryabina, 2002b).

To account for the performance of behaviours that are not completely under the subject's control, the Theory of Planned Behaviour was proposed by Ajzen (1985) as an extension to the Theory of Reasoned Action. Many factors can interfere with control over intended behaviour. These factors can range from being internal - skills, abilities, and knowledge; and external - such as time, lack of resources, cooperation and behaviour of other people, opportunity. To take these factors in to account, the Theory of Planned Behaviour adds a third dimension to the Theory of Reasoned Action, the Perceived Behavioural Control (PBC) which can be defined as a person's belief as to how easy or difficult performance of the behaviour is likely to be and represents the degree to which the individual believes that behavioural performance is complicated by internal and external factors.

The following diagram demonstrates how the Theory of Planned Behaviour works:

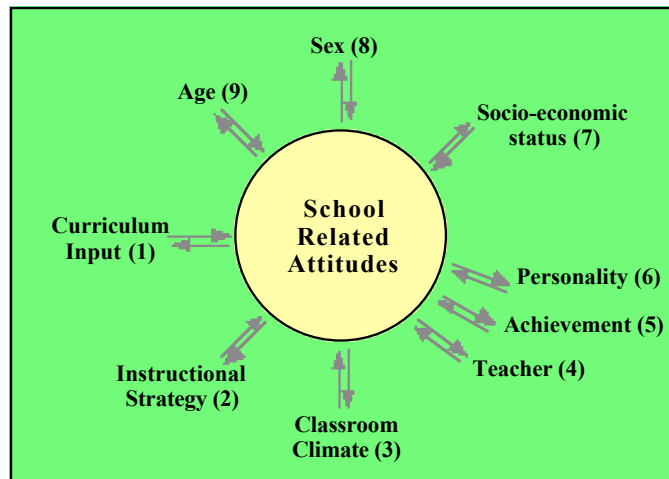


**Figure 6.4 Theory of planned behaviour (after Skryabina, 2000)**

This well attested model offers an important insight into measurement. Behaviour (in interviews and from questionnaires) is observed and attitudes are inferred from this. This will only be valid if the effect of the subjective norm and the perceived behavioural control are minimised. Questionnaire design and interview approaches need to reflect this.

Khan and Weiss (1973) listed the factors that influence attitudes (see figure 6.4). These variables could be divided into two categories:

- (a) Internal factors: personality, intelligence, achievement, gender, age.
- (b) External: teacher and class room atmosphere, home background, the curriculum, instructional variables.



**Figure 6.5 Attitude and its variables**  
(from Reid, 1978, derived originally from Khan and Weiss, 1973)

It is noteworthy that such factors are not necessarily equally important and their importance may differ from person to person. Achievement is very important in relation to attitudes for many learners. Numerous studies confirm what teachers have always known: students who do well tend to hold very positive attitudes (Barrington and Hendericks, 1988; Weinberg, 1995). Positive attitudes and good performance simply go together, each feeding off the other (Figure 6.6).



**Figure 6.6 Attitudes and Performance**

Soh (1973) worked with English secondary school boys from both science-oriented and non-science-oriented disciplines and he suggested that potential scientists were less pleasure seeking and were concerned more with school interests and family relationships. Another important factor influencing attitudes is age. Piburn and Baker



(1993) and Ramsden (1998) discovered that positive attitudes of students towards science decline with age. On the other hand, Barrington and Henderiks (1988) found that the students between ages 8-12 exhibit a *serious* decline in their attitudes. They also found that their attitudes undergo a striking improvement at age 16, especially in the case of bright students. According to Simpson and Oliver (1985), attitudes towards science decline rapidly from the commencement of the academic year to the middle of the year and slowly from the middle to the end. Several studies have reported that attitudes towards science decrease over time of secondary schooling and more negative views are associated with Physical Science than Biological Science (eg, in England, Ramsden, 1998).

After conducting interviews with elementary, junior and high school students, Piburn and Baker (1993) proposed that the origins of the decline in attitude towards science are in the nature of “*classroom instruction and the relationships among people in classroom*”. In the beginning of their study, the students enjoyed science because they were excited and fascinated with the many action-oriented and open-ended scientific activities that awaited them. However, the junior school students soon became frustrated with open-ended activities. Piburn and Baker (1993) also proposed that for the decline in the upper school level, students develop a “*strong work ethic and seemed to appreciate schoolwork, including tests, which they believed helped them to learn*”. However, Piburn and Baker see the primary reason that is influencing the decline of attitude towards science with age rests in the “*isolation of students as they moved through the grades. As the number of opportunities for students-students and students-teacher interactions, both academic and social, decline, negative attitudes towards science increased*”. However, this must be true for other school subjects and cannot, therefore, be the only reason. Piburn and Baker also see the growing intricacy and

abstraction of science lessons This may be a better explanation to have an unfavourable effect on attitudes towards science.

Finally, the last internal factor on attitude towards science is gender. According to Germann (1988): *“The education process is a social one in which the learners and the teacher come together in an effort to shore meaning concerning the concepts and skills of the curriculum”*. The Classroom Environment and the Teacher are external factors that influence attitudes towards science. Germann (1988) conducted a study on the function of classroom environment and teacher in helping shape attitudes towards science. He discovered that students with *“better instructional methods and better learning environment had significantly better attitudes than those of the poorer teacher. When the teachers were of comparable experience, there was found to be no significant difference in students’ attitude towards science”*. This consolidates what other scientists have said about the pivotal role of teachers. It is the teacher who can create a positive classroom atmosphere for students. The teacher has to stimulate the students’ minds by making the lesson challenging, entertaining and inspiring. Haladyna and Shaughnessy (1982) also re-iterated that the teacher and the classroom environment play momentous roles in affecting students’ attitudes.

The study by Skryabina in Scotland (Reid and Skryabina, 2002a) gave a much more detailed pattern of outcomes. She looked at attitudes towards physics and found that the pattern of decline observed elsewhere was not observed in Scotland. Positive attitudes fell at some stages and grew markedly at others. She could relate this specifically to the curriculum and the way the subject was taught. She was also able to pinpoint the precise effect of the curriculum on boys and girls (Reid and Skryabina, 2002b) and found that, in the Scottish secondary school curriculum, once a girl had elected to study physics, she tended to stay with it. This large study has revealed many of the precise reasons why attitudes towards physics may be positive or negative and has defined the key

factors which influenced attitudes: quality curriculum, teachers, perceived remuneration prospects. It is highly likely that her findings apply much more widely than just to Physics.

## **6.7 Methods Used in This Study**

The aim of this study is to explore what is going on in the Bahrain quality assurance educational system (Secondary Schools) in a country where the whole system has expanded at a very fast rate and is showing some signs of stress. The longer-term aim is to see what can be done to enhance quality. The students are central and the measurements will focus on the perceptions of the students and their teachers. An overall picture is wanted.

For this purpose, questionnaires and interviews offer a useful way forward. The aim will be to gain insights into the perceptions of student teachers and educational administrators of aspects of the quality of secondary education in Bahrain. This will reveal something of the attitudes of the participants. The details of the approach adopted will be outlined in the following chapter.

## **6.8 Conclusions**

Attitudes have been widely measured using a variety of techniques but it is commonly assumed that it is difficult to infer behaviour precisely from these measurements. In 1973, Ajzen and Fishbein assert the idea that attitudes measures are unable to predict exactly certain modes of conduct and that they may only help in discovering the behaviour *intention*. In 1974, Himmelfarf and Eagly observed that “*one of the salient features of recent research is the great number of studies demonstrating that the*

*empirical generalizations of earlier research are not general, but contingent on conditions not originally apparent*” while, in 1974, Liska suggests that “*attitude measurements can only be used to predict behaviour when they both refer to equivalent levels of generality.*” However, attitude measures do give indications of subsequent behaviour but the predictions are by no means exact.

It has to be remembered that attitudes do not simply involve the cognitive. Thus, simply presenting information may not, of itself, generate desired attitudes in the listeners. Thus, presenting facts and concrete concepts, in a dictating or didactic manner, may not lead to what is intended. This may be exacerbated if the teacher uses one teaching method or assessment questions concentrating on mechanical memorization and factual recall. This leads to loss of opportunities to develop thinking skills, understandings and positive attitudes. Thus, the teacher may unwittingly become an obstacle in developing positive attitudes towards the subject or to learning in general.

This chapter has attempted to present a very brief overview of the area of attitude measurement. In this study, the methods developed by Likert (1932) and Osgood *et al.* (1967) will be employed. However, the faulty methods of scaling will not be used and all analyses will consider each question on its own. In this, the student perceptions of specific areas of interest will be explored.

Attitudes involve evaluations (using the underpinning insights from Eagly and Chaiken, 1993) and, here, the aim is to secure insights into the perceptions of both students and their teachers relating to their educational experiences, with the aim of understanding how they have seen the quality of that educational provision.

**Chapter 7****Some Views on Bahrain Secondary School Provision****7.1 Gaining an Overview**

In looking at quality assurance, the first stage seeks to find out how some key stakeholders see present provision in secondary education (ages 15-18) in Bahrain. The aim is to gain an overview of perceptions and to identify areas where there are issues to be addressed.

The most important group are the learners and, to gain the greatest insight, school students towards the end of their final year at school (aged 18) were included in the sample. These students were asked to look back at their experiences in school, the aim being to see where there are strengths and weakness in current educational provision as well as ways by which the current system might be enhanced.

The second key group are the teachers. They have responsibilities for teaching at secondary stages and their perceptions of what is happening are vital. The final group are those who have overall responsibilities for the education provision in the Kingdom, at school and national level in the Kingdom. The question is what insights each group can bring that relate to quality and what practical issues can they identify that need addressed.

In conducting this set of surveys, large numbers need to be involved in order to gain an accurate picture. As far as possible, anonymity is important to avoid gaining answers perceived as '*desirable*'. The overall goal is to gain an accurate overview and define an agenda for the next stages of the research.

## 7.2 Methodology

Three groups were involved. The students in the secondary schools are arguably the most important in that the educational provision is designed for their benefit. Their teachers are also critically important in that they have the demanding task of ‘*delivering*’ the educational provision. However, what is to be taught and the resources available are decided mainly by educational administrators and their perceptions are also critical.

In order to explore how school learners can be brought to the focus of the quality issue, a sample of 793 students, aged 18, at the end of their school career, were asked to look back on recent aspects of their educational journey. The school students were studying in the Kingdom of Bahrain where there is a highly organised school system, a well resourced education system and a quality assurance procedure has been operating since 2008. In addition, a sample of 793 secondary teachers were also surveyed and a sample of senior professionals in education were interviewed.

The size of the two groups (students and teachers) is large. A sample of about 800 students is desirable in that it was considered that it might be possible to analyse sub-groups, like gender, school type. In general, education is gender separated in Bahrain. The students were selected by schools so that the diversity of schools was chosen to reflect the total population, taking into account the catchment areas of schools and whether they were rural or urban.

The teachers were also drawn randomly from across the schools in the country and represent a typical cross section of the population. The sample is very large, again reflecting the initial interest at the possibility of looking at sub-groups. In the event, limited use was made of analysis by sub-group in that so much rich data was obtained

from the entire group. However, the large samples give increased confidence in reliability (Reid, 2003).

The educational administrators group is a very much smaller group and represents the majority of those involved in such tasks. The small number made the use of questionnaires inappropriate and interviewing was used instead.

In all three cases, the methods used to gain access had to follow the procedures which operate in Bahrain. After ethical clearance in Dundee, letters were written to the key officials in the Ministry of Education. Following their approval, schools and individuals were approached. The letters are shown in the appendix (6).

### **7.2.1 The Questionnaires**

It was not possible to use the same questionnaire with both teachers and students, simply because the teachers were being asked about quality assurance from a teacher perspective and the students were giving their insights on how they had found their educational journey on looking back. The two perspectives are totally different.

Both surveys employed several formats based on the work of Osgood *et al.* (1957) and Likert (1932). Reid (2003) has summarised the various formats available, with exemplars, while Reid (2006) discusses the principles for this kind of measurement. There were 54 questions for students and 45 for teachers. The number of questions merely reflects the issues to be explored.

The semantic differential questions (Osgood *et al.*, 1957) use a six point scale while the Likert questions (Likert, 1932) use five from '*strongly agree*' to '*strongly disagree*'. There were also some open-ended questions and some rating questions. The surveys are shown in full in the appendix (1,2) along with the interview schedule.

Questions used in surveys often employ 4, 5 or 6 points scales. The pattern used here reflected the seminal work of Skryabina (2000) in her monumental study of attitudes related to physics (see Reid and Skryabina, 2002a). Ideas for the questions were gathered from her work and the many studies which have drawn from her work (eg. Al-Shibli, 2006; Shah *et al*, 2007; Chu, 2008 ). However, the questions had to be new in that the topic of quality assurance has not been explored in this way in any study found.

The data analysis follows the principles laid down in Reid (2003, 2006). The data will be presented descriptively here, as percentages. Gender comparisons are conducted using chi-square as contingency test is employed, using frequency data.

### 7.2.2 The Survey of Teachers

The questionnaire for teachers sought to gain insights into teacher's perceptions about:

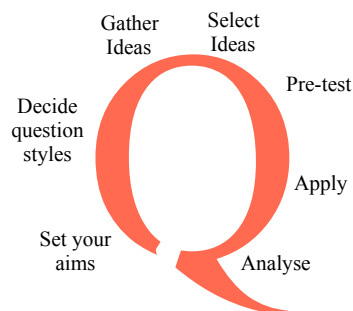
- ☒ Their experiences in quality assurance in education.
- ☒ The reasons why quality assurance in education is important in teaching and learning.
- ☒ Their preferred style of training in relation to quality assurance in education in order to enhance teaching and learning.
- ☒ Their opinions about the general views of quality assurance.
- ☒ Their opinions about the most helpful aspects in ensuring high quality education.
- ☒ Their opinions about the curriculum, training and examinations.

Denscombe (1998) proposed formulating a list of written questions that relate to the aims of a study. It is practical to seek advice from experts who are familiar with the situation in order to select the appropriate questions. It is imperative that vagueness in the questions is avoided in order to allow teachers to understand the meaning that the designer intends to convey. This practice will augment consistency and precision and will enable the answers to be processed easily, thus reinforcing the validity and reliability of the questionnaire. Reid (2003) has outlined a set of practical guidelines in developing questionnaire and these were followed here:



- “(a) Jot down as accurately as possible what you are trying to find out.*
- (b) Settle on what types of questions would be helpful.*
- (c) Be creative and write down as many ideas for questions as you can.*
- (d) Select what seem the most appropriate from your list - keep more than you need.*
- (e) Keep the English simple and straightforward, avoid double negatives, keep negatives to a reasonable number, look for ambiguities, and watch for double questions.*
- (f) Find a critical friend to comment on your suggested questions.*
- (g) Pick the best, most appropriate and relevant questions, thinking of time available.*
- (h) Layout is everything!*
- (i) Try your questionnaire out on a small sample of students (e.g. a tutorial group) - ask for comments, criticisms. Check time required.*
- (j) Make modifications and only then apply to larger group.*
- (k) Analyze each question on its own.”*

Reid (2003) illustrated these guidelines through a simple diagram shown below.



**Figure 7.1 Summary of instructions for the development of a questionnaire**

The validity of a measuring instrument, defined as the extent to which the instrument can measure what is expected to be measured, was checked by allowing a group of experienced teachers who knew the student population to scrutinize the questions, adjustments being made in the light their comments.

The questionnaire was applied in May 2010 and 793 completed questionnaires were returned from teachers in typical secondary schools, the only questionnaires not returned being from the few who were absent that day.

Each question is discussed in turn later, with the full data shown as percentages for clarity. All statistical calculations were carried out using frequency data. The questionnaire is shown in full in the appendix.

The total population of teachers involved in the study is as follows:

Teachers	Number
Male	389
Female	404
Total	793

**Table 7.1 The total population of teachers**

The number of schools in which the questionnaires were applied were twelve secondary schools, six for boys and six for girls. The data obtained were collated on a spreadsheet. The SPSS (Statistical Package for the Social Sciences) program and a program for computing chi-square using a spreadsheet were used to carry out statistical analyses. The results from each question are now discussed in turn. Each question is shown as in the questionnaire and the data are shown as percentages, for clarity, for the whole sample of 793. However, all statistical calculations were conducted using the raw data.

Details of the statistical techniques used are in appendix (4).

### 7.2.3 The survey of Students

The questionnaire was aimed to gain insights into students' opinions about:

- ☒ Learning in schools
- ☒ Their preferred way of learning.
- ☒ Their school experience during the last 12 months.
- ☒ The reasons for choosing coursing various courses
- ☒ Their preferred favorite subjects
- ☒ Their recent school experiences
- ☒ The way they like to learn.

The questionnaire was applied in May 2010 and 793 completed questionnaires were returned (again almost 100% return rate, only those absent on that particular day being missing). The original form of the questionnaire is shown in the Appendix (1). The permission and support from the Ministry of Education was acquired first as with the teacher's questionnaire and 793 surveys were distributed to twelve secondary schools in the Kingdom of Bahrain. The instructions to teachers was to hand out the questionnaires, allow enough time for completion and collect them back in. The questionnaire made it clear that responses would not affect their school grades in any way.

The total population of student's involved in the study is as follows:

Students	Number
Boys	415
girls	378
Total	793

**Table 7.2 The total population of students**

The data were handled in the same way as the teacher's data.

In this section, the methods used for the results and student's perceptions on quality assurance are discussed. Data are presented as percentages for clarity.

### 7.3 Data analysis for Survey of Teachers

Each question is considered in turn.

(1) What are your opinions about your <i>experiences in quality assurance in education</i> ?											
Men: N = 389, Women: N = 404, Total: N = 793, Data as %								$\chi^2$	df	p	
Useful	Men	43	15	15	9	6	12	Not useful	20.1	4	< 0.001
	Women	45	21	16	11	2	6				
	Total	44	18	15	10	4	9				
Not helpful	Men	33	22	16	10	8	11	Helpful	11.5	5	< 0.05
	Women	40	23	15	10	4	8				
	Total	37	22	16	10	6	9				
Understandable	Men	22	18	18	12	8	22	Not understandable	14.7	5	< 0.01
	Women	26	19	19	15	10	11				
	Total	24	19	19	13	9	16				
Satisfying	Men	18	18	17	16	11	20	Not satisfying	8.1	5	n.s
	Women	20	21	21	16	10	13				
	Total	19	20	19	16	10	17				
Has not improved education	Men	23	15	14	17	12	19	Has improved education	11.4	4	< 0.05
	Women	18	18	16	11	15	22				
	Total	20	17	15	14	13	20				
Difficult to carry out	Men	26	15	19	18	12	11	Easy to carry out	5.9	5	n.s
	Women	20	17	21	18	11	13				
	Total	23	16	20	18	12	12				
Mostly done.	Men	15	15	22	16	13	17	Often omitted	39.8	5	< 0.001
	Women	26	24	19	16	7	8				
	Total	21	20	21	16	10	13				
Important	Men	30	21	18	14	6	11	Not important	14.8	5	< 0.01
	Women	37	22	19	13	4	5				
	Total	34	22	18	14	5	8				
Well organized	Men	19	17	20	18	11	15	Not well organized	7.1	5	n.s
	Women	21	19	22	15	12	9				
	Total	20	18	21	17	12	12				
Irrelevant in education	Men	17	11	13	15	14	30	Essential in education	10.8	5	< 0.05
	Women	13	9	16	10	18	34				
	Total	15	10	15	12	16	32				

**Table 7.3 Experiences in Quality Assurance**

The most positive views can be seen in relation to usefulness, importance and relevance to education. Thus, teachers recognise the importance of quality. However, their experiences of quality assurance are generally regarded as unhelpful and the process is regarded as difficult to carry out. Their views are scattered in relation the process being seen as satisfying while they are very uncertain if it has improved education. The overall impression is that the teachers are supportive of the principle of quality assurance but they are much less convinced that what is being done is the right way forward.

In general, the women are more positive than the men although the women are slightly less convinced that their experiences are helpful. The men are markedly less certain that the process has been carried out.

(2) Why quality assurance in education is important in <i>teaching and learning</i> ? Teachers asked to tick the <i>three</i> descriptions they think are <i>important</i> .		
% Men: N = 389, Women: N = 404, Total: N = 793, Data as %		
26	Aims to makes teaching and learning more enjoyable.	Improvement
26	Enables standards to be checked.	Accountability
34	Aims to introduce new methods into teaching.	Improvement
23	Ensures that all schools follow the same procedures.	Accountability
14	Aims to produce better examination results.	Improvement
18	Ensures that all teachers do the same things.	Accountability
11	Makes the theory of teaching more obvious.	Improvement
28	Improves teaching skills.	Improvement
21	Aims to produce better educated students.	Improvement
7	Generates more freedom for teachers.	Improvement

**Table 7.4 Importance of Quality Assurance for Teaching and Learning**

While teaching and learning are part of quality assurance, the reasons for its presence are often not explicit. The aim of question 2 was to find out the thoughts of the teachers about the purpose of quality assurance in education. The final column was not on the original survey but the ten responses were classified as shown the final column.

The teachers seem to see the importance more in terms of improvement. Some of the seven reasons cannot be regarded as fundamental reasons for undertaking quality assurance in teaching and learning: aims to produce better examination results (14%), makes the theory of teaching more obvious (11%), generates more freedom for teachers (7%). The percentages of teachers choosing these three reasons are quite low. The spread of responses does suggests that teacher show diverse views and reasons for undertaking quality assurance and that there is a need for clarification in the country.

(3) For <i>training in quality assurance</i> in education for developing teaching and learning, teachers indicated.		
Men: N = 389, Women: N = 404, Total: N = 793, Data as %		
62	On-going training.	31
		Training at start.
		7
		No need for training.

**Table 7.5 Need for Training**

It is clear that training is wanted, with about two thirds preferring on-going training.

(4) Which <b>most closely reflects</b> your views ?									
Men: N = 389, Women: N = 404, Total: N = 793, Data as %							$\chi^2$	df	p
I feel that the quality assurance system in education works well.	Men	13	32	26	20	10	21.6	4	< 0.001
	Women	10	41	32	13	5			
	Total	11	37	29	16	7			
There is not enough discussion in my school about the quality assurance system in education.	Men	21	37	18	20	5	45.3	4	< 0.001
	Women	9	26	26	28	11			
	Total	15	31	22	24	8			
Using quality assurance system in education helps me do things more accurately.	Men	12	44	23	16	6	0.4	4	n.s
	Women	13	44	24	15	5			
	Total	13	44	23	15	5			
The quality assurance system in my school helps me use more varied teaching methods.	Men	15	42	24	14	5	13.0	3	< 0.001
	Women	20	50	20	9	3			
	Total	17	46	22	11	4			
I am not involved with the quality assurance system in my school.	Men	14	23	28	24	11	13.4	4	< 0.01
	Women	7	22	26	30	15			
	Total	10	23	27	27	13			
A quality assurance system is essential in education to achieve good standards.	Men	23	37	22	14	4	11.3	4	< 0.05
	Women	19	47	21	9	4			
	Total	21	42	21	12	4			
I feel using a quality assurance system in education is difficult.	Men	10	25	28	29	8	5.2	4	n.s
	Women	7	25	33	28	7			
	Total	9	25	31	28	8			
I consider using a quality assurance system in education in teaching is a waste of time.	Men	10	22	23	30	15	8.3	3	< 0.05
	Women	6	18	27	37	13			
	Total	8	20	25	33	14			
The instructions and guidelines of the quality assurance system in education are clear to me.	Men	9	34	27	21	9	2.8	4	n.s
	Women	8	39	26	21	7			
	Total	8	36	27	21	8			
The Ministry of Education does not follow up the findings from quality assurance.	Men	12	24	29	26	10	11.6	4	< 0.05
	Women	7	19	37	26	11			
	Total	9	21	33	26	10			
The Ministry of Education does not focus enough on the most important aspects of education.	Men	18	28	25	20	9	7.7	4	n.s
	Women	16	33	26	20	5			
	Total	17	13	27	20	7			
The quality assurance system has improved my skills as a teacher.	Men	10	32	24	25	9	12.4	4	< 0.05
	Women	13	38	26	16	7			
	Total	12	35	25	21	8			
I should like the quality assurance system to include more practical training programmes.	Men	35	40	14	8	3	14	3	< 0.01
	Women	38	44	15	2	2			
	Total	37	42	14	5	2			
The quality assurance system has improved the educational experiences of my students.	Men	9	29	27	22	13	14.9	4	< 0.01
	Women	9	36	32	16	8			
	Total	9	32	29	19	10			

**Table 7.6 General Views**

The question deals with a wide range of issues. As before, where there are differences between men and women in the response patterns, the women are slightly more positive

than the men. It is clear that their views are very positive about the value of quality assurance in encouraging good, varied teaching, with good standards. Overall, quality assurance is not seen as a waste of time although over one quarter do not share that view.

While they tend to think that the quality assurance system works reasonably well, with general instructions adequate, again sizeable minorities do not share these views. They are somewhat ambivalent that the process has either improved teaching skills or the educational experience of the students. There are areas where unhappiness is very evident. The lack of discussion and training is noted. It seems that teachers do not feel that they have any ownership of the process. There is also doubt about the Ministry of Education focussing on the most important aspects or following up findings.

The most clear-cut finding relates to training: teachers are desperate in wanting practical training in relation to enhancing quality.

(5) <i>The most helpful in ensuring <b>high quality education</b>?</i> <i>Teachers asked to tick the <b>THREE</b> descriptions they think are the <b>most helpful</b>.</i>	
<i>Men: N = 389, Women: N = 404, Total: N = 793, Data as %</i>	
20	Visits by school inspectors.
25	Examination results analysed.
36	Teachers being trusted.
17	School students being asked.
8	Visits by education managers.
12	Outsiders visiting schools.
19	Head teachers being trusted.
12	Classes being observed.
10	Schools compared by visitors.
24	Schools helping each other.
12	No formal quality assurance.
14	Resources being analysed.

**Table 7.7 Most Helpful Aspects**

One marked feature here is that teachers are simply asking to be trusted, suggesting that there is a real danger that quality assurance procedures are undermining this. They also want head teachers be trusted. Humes (2012) has noted the importance of trust when he states,

*“Staff are much more likely to show commitment and gain job satisfaction if they are treated with respect, listened to when changes are proposed, given support when under pressure, and accountable to managers who lead by example rather than exhortation.”*

The teachers still see examination results as an indicator of quality despite the evidence to the contrary. It is quite easy to show that examinations results can vary widely from year to year in any school, simply because the general ability level of samples of students can vary considerably from year to year (Reid, 2012). It is also possible to show that the greatest factor influencing the examination outcomes is not what the school does but the nature of the intake into the school (eg. Goldstein Thomas, 1996). There are numerous variables that can influence examination success, the quality of the teaching only being one: the previous achievements of the learners, the quality of school intake, support from homes, quality of resources available, school culture, community culture and so on.

Schools helping each other (24%) and visits by school inspectors (20%) are also stressed as well as aspects of effective teaching and learning. In five areas, the ratings are quite low: visits by education managers (8%), schools compared by visitors (10%), outsiders visiting schools (12%), classes being observed (12%) and no formal quality assurance (12%). It can be deduced that they believe in quality assurance. However, they clearly have little confidence in outsiders (those outside the life of the schools) conducting this.

In chapter 3, an important feature of Danielson’s work is the way she challenges the idea of teachers being assessed by outsiders infrequently visiting the teaching situation. She notes how this is so artificial and unrealistic. Indeed, as soon as an outsider enters the teaching room, the situation in the room has changed and it is totally unrealistic to try to make any kind of judgement based on one visit. One of her major contributions is the way she sees trained evaluators, who are still teachers, being a major part of the whole process. She seeks to shift the emphasis away from what is traditionally called, ‘*inspection*’ to what she calls ‘*collaborative reflection*’ (Danielson Group, undated).



(6) Which <b>most closely reflects</b> your views ?									
Men: N = 389, Women: N = 404, Total: N = 793, Data as %							$\chi^2$	df	p
The curriculum plan for my subject is clear.	Men	38	43	13	3	2	7.0	4	n.s
	Women	40	42	9	7	2			
	Total	39	43	11	5	2			
I have been trained in the curriculum for my subject.	Men	21	41	16	15	6	28	3	< 0.001
	Women	13	34	18	25	11			
	Total	17	38	17	20	8			
The textbooks in my subject cover the curriculum well.	Men	22	41	18	15	4	8.7	3	< 0.01
	Women	14	44	23	15	4			
	Total	18	43	21	15	4			
There are good training programmes to enable me to teach my subject.	Men	15	33	23	22	8	14.4	4	< 0.01
	Women	8	31	25	25	12			
	Total	11	32	24	23	10			
The syllabus has been distributed to me on time.	Men	17	36	24	18	6	9.4	4	< 0.05
	Women	11	38	23	18	10			
	Total	14	37	24	18	8			
There is guidebook for teaching my subject.	Men	19	34	15	18	14	5.3	1	< 0.05
	Women	16	29	17	20	18			
	Total	17	31	16	19	16			
There is a good guidebook for practical work in my subject.	Men	14	37	19	18	12	7.9	3	< 0.05
	Women	11	31	18	23	17			
	Total	12	34	19	20	15			
The textbooks in my subject make the subject accessible for my students.	Men	22	41	19	15	3	5.0	4	n.s
	Women	20	42	20	13	6			
	Total	21	42	19	14	4			
The curriculum in my subject is appropriate for my students.	Men	17	40	20	16	6	1.9	4	n.s
	Women	15	38	24	17	6			
	Total	16	39	22	17	6			
The national examinations test my subject well.	Men	14	28	39	14	6	16.1	4	< 0.01
	Women	6	31	46	12	5			
	Total	10	29	42	13	6			
My students pass the national examinations in my subject are too long.	Men	13	27	40	14	6	8.3	3	< 0.05
	Women	7	28	46	12	8			
	Total	10	27	43	13	7			
The papers in the national examinations in my subject are too long.	Men	11	20	44	22	4	19.4	4	< 0.001
	Women	5	21	57	16	2			
	Total	8	20	51	19	3			
The national examinations in my subject are not linked enough to the textbooks.	Men	9	23	41	20	7	14.7	4	< 0.01
	Women	4	17	53	19	7			
	Total	7	20	47	19	7			
The education in my subject is a good preparation for life.	Men	20	46	20	9	5	8.0	3	< 0.05
	Women	17	40	24	15	6			
	Total	18	43	22	12	5			

Table 7.8 Further Insights

Question 6 looks more at aspects of the curriculum and training. Teachers are most positive relating to curriculum planning and content, and textbooks. They are less positive relating to training in the curriculum, curriculum support materials and issues relating to national examinations. Indeed, they tend to consider national examinations as too long and not linked to enough to textbooks. The need for training again stands out.

Looking at gender comparisons, in many questions the men are slightly more positive although, sometimes, the women hold more neutral views when compared to the men.

#### **7.4 Summary**

Overall, teachers views are very positive about the idea of quality assurance in education. They recognise the importance of quality. On the other hand, their experiences of quality assurance are generally regarded as unhelpful and the process is difficult to carry out while they are very uncertain if it has improved education. They seem to see the importance more in terms of improvement. One important marked feature is teachers are simply asking to be trusted. However, they clearly have little confidence in outsiders and they mention that training is wanted (on-going training).

It is difficult not to support the idea of quality but it is very different to describe what is meant by quality, and how to achieve it. Indeed, there is no shared agreement on the balance between accountability and improvement and there is no shared understanding of what is meant by improvement.

The ineffectiveness of school visits and classroom observations is also raised, these issues being stressed eloquently by Danielson (Danielson Group, undated)

## 7.5 Data analysis for Survey of Students

(1) What are your opinions about <i>learning in school</i> ?											
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %									$\chi^2$	df	p
I feel I am coping well.	Boys	28	29	19	11	6	7	I feel I am not coping well.	13.7	5	< 0.05
	Girls	31	19	20	14	6	10				
	Total	30	24	19	12	6	9				
I am not enjoying school.	Boys	13	11	17	22	19	13	I enjoy school.	10.2	5	n.s
	Girls	13	10	18	15	19	25				
	Total	13	10	17	18	19	22				
I have found school work easy.	Boys	12	13	26	19	13	16	I have found school work difficult.	14.7	5	< 0.05
	Girls	10	12	20	19	12	27				
	Total	11	13	23	19	12	22				
My school results are getting worse.	Boys	12	10	18	20	21	19	My school results are getting better.	5.3	5	n.s
	Girls	14	8	14	19	21	23				
	Total	13	9	16	20	21	21				
School is giving me benefits.	Boys	29	25	16	14	7	10	School is giving me no benefits.	5.0	5	n.s
	Girls	32	20	18	12	8	11				
	Total	30	22	17	13	7	11				
Work at school is relevant to my needs.	Boys	11	13	22	21	16	18	Work at school is irrelevant to my needs.	8.3	5	n.s
	Girls	15	12	23	19	11	21				
	Total	13	12	22	20	13	19				
My parents are interested in my education.	Boys	77	10	5	2	1	5	My parents are not interested in my education.	3.1	3	n.s
	Girls	81	7	4	3	2	4				
	Total	79	8	5	3	1	4				

**Table 7.9 Students opinions about learning in school**

The aim of question 1 was to find out how students feel towards their experience at school. It is clear that the students overall attitudes towards the principles of learning in school were generally positive. The views of students are very strongly in positive agreement with the statement “*My parents are interested in my education*”, reflecting the strong family structure in Bahrain.

In general, students tend to be confident they are coping well and that the school is bringing them benefits. However, they are less confident that school is relevant to their needs. Overall, they tend to find school work difficult but they do feel they are making progress.

There are almost no differences between the boys and girls in their expressed views.

(2) What are your opinions about <b>your preferred way of learning</b> ?											
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %								$\chi^2$	df	p	
I find my textbooks unhelpful.	Boys	16	18	20	17	16	15	I find my textbooks helpful.	5.5	5	n.s
	Girls	19	14	18	17	14	19				
	Total	17	16	19	17	15	17				
Examinations do not help me to learn.	Boys	13	14	14	20	19	20	Examinations help me to learn.	4.7	5	n.s
	Girls	17	13	16	19	15	20				
	Total	15	13	15	20	17	20				
I enjoy practical work at school.	Boys	32	18	14	10	10	17	I do not enjoy practical work at school	5.3	5	n.s
	Girls	32	16	12	15	10	16				
	Total	32	17	13	13	10	16				
I like the way the school is run.	Boys	10	15	18	14	17	26	I do not like the way the school is run.	9.9	5	n.s
	Girls	13	12	16	11	14	34				
	Total	12	13	17	13	15	31				
School shows me what to memorise.	Boys	24	18	23	18	9	8	School shows me what to understand.	20.6	5	< 0.001
	Girls	28	11	24	12	11	14				
	Total	26	14	23	15	10	11				
Most subjects at school are useful.	Boys	10	18	21	18	14	19	Most subjects at school are not useful.	13.9	5	< 0.05
	Girls	18	16	17	13	13	22				
	Total	14	17	19	16	14	21				
I prefer working on my own.	Boys	8	7	10	12	18	45	I prefer working with others.	17.5	5	< 0.01
	Girls	15	6	10	9	11	49				
	Total	12	6	10	10	14	47				

Table 7.10 Students preferred way of learning

Table 7.10 reveals some interesting insights. On the positive side, practical work is popular, although observations made by school inspectors in the schools show that, with the overloaded curricula, practical work in schools is sometimes not undertaken.

The students are more negative about the way the schools are run, perhaps simply reflecting adolescence. It is sad that they see schools as telling them what to memorise, the girls holding slightly more polarised views here. This does reflect the current emphases in curricula, textbooks and examinations. Their views of textbooks vary widely, suggesting not all is well here while they are not very positive about the role of examinations. The emphasis on memorisation may also be influencing the way they do not always see school subjects as useful.

The most marked pattern of responses comes in thinking of their preferred way of working. In life, people tend to work in collaboration with others. In schools, students are forced to learn much of their time on their own while collaboration is often labelled as ‘*cheating*’. The students are giving a clear message that they want more opportunities to work collaboratively.

(3) Think of your school experience during the last 12 months.											
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %								$\chi^2$	df	p	
I enjoyed it.	Boys	23	20	23	13	6	14	I hated it.	16	5	< 0.01
	Girls	34	19	21	7	4	14				
	Total	29	19	22	10	5	14				
It was too easy.	Boys	5	12	31	23	14	16	It was too difficult.	7.4	5	n.s
	Girls	8	15	27	24	11	16				
	Total	6	13	29	23	12	16				
It helped me to think of possible careers.	Boys	18	22	19	15	9	17	I still do not have a clear career direction.	18.9	5	< 0.01
	Girls	31	17	15	16	9	12				
	Total	25	20	17	15	9	15				
There was not enough time in science.	Boys	8	10	12	19	18	33	There was too much time in science.	20.0	5	< 0.01
	Girls	10	6	13	12	13	46				
	Total	9	8	13	15	15	40				
I did well in my exams.	Boys	20	20	24	16	8	13	I did badly in my exams.	4.5	5	n.s
	Girls	25	17	22	14	8	14				
	Total	22	19	23	15	8	13				
My best marks came in arts subjects.	Boys	20	13	17	16	9	25	My worst marks came in arts subjects	1.0	5	n.s
	Girls	21	14	18	15	10	22				
	Total	21	13	17	16	10	23				

**Table 7.11 Students School experience during the last 12 months**

In general, the students have enjoyed the past 12 months, felt it helped them to think of possible careers and they did well in examinations. In terms of difficulty, the data suggest that the balance is about right.

Their views of their performance in the arts subjects vary widely. However, there is a strong view that too much time is spent in the science subjects, this being more marked for the girls. This might reflect curriculum imbalance (science has a very high profile in Bahrain) or it might reflect inappropriate science curricula where the subject matter can be abstract and difficult to understand.

(4) You will like some subjects better than others.											
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %											
Subject	First Choice favorite subject			Second Choice favorite subject			1st + 2nd	Last Choice least subject			Popularity
	Boys	Girls	Total	Boys	Girls	Total		Boys	Girls	Total	
Arabic	4	6	5	4	6	7	6	19	17	18	0
English	14	15	14	10	11	10	12	14	20	17	7
Mathematics	28	23	24	14	17	16	20	28	18	23	17
Biology	7	14	10	5	10	8	9	9	1	4	14
Chemistry	3	2	2	7	4	5	4	11	6	8	-1
Physics	4	2	3	15	2	8	6	7	12	9	2
General Science	4	3	3	6	4	5	4	2	5	3	5
Geography	5	4	4	8	4	6	5	7	15	11	-1
History	0	0	0	1	1	1	1	1	0	0	1
Accounting	7	11	9	4	10	7	8	0	1	0	16
IT	2	1	1	2	1	1	1	1	0	0	2
Business	2	4	3	3	10	6	5	1	1	1	8
Islam	7	7	7	10	9	9	8	0	0	0	16
Sport	7	2	4	6	3	4	4	0	1	0	8
Art	1	1	1	1	1	1	1	0	0	0	2
Other	5	5	10	4	7	6	8	0	3	6	10

**Table 7.12 Students like some subjects better than others**

There are three types of schools in Bahrain (Primary - Intermediate - Secondary) and the Arabic, Mathematics, English and Islamic Studies are offered in all three types of schools. There are three types of academic streams in secondary schools in Bahrain (science, literary, commerce) and the Arabic, Mathematics, English and Islamic Studies are offered in all three types of schools. This may partly explains their higher popularity. However, biology and accounting stand out as highly popular. Is the popularity due to the curriculum, the way of teaching or the way of assessing, or some combination of these and other aspects? By contrast, chemistry and physics do not perform well in the popularity stakes.

The final part of the question was open-ended and asked about the reasons why they like their favorite subject. Their responses were grouped under a number of headings as shown in table 7.13, which presents the findings in rough order of frequency.





(4) <i>You will like some subjects better than others. Thinking of their favorite subject, students explain why they like it best.</i>			
<i>Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %</i>			
<i>Students explain</i>	<i>Boys</i>	<i>Girls</i>	<i>Total</i>
Understandable, made me think.	36	29	32
Creative and enjoyable teaching.	24	21	22
Easy to learn.	16	21	18
Teaching method effective.	10	13	11
Learning about culture.	3	2	3
Learning about life.	2	4	3
Discovery of new knowledge.	2	3	3
Learning practical work.	3	2	3
Memorizing.	2	1	1
Others.	2	4	4

**Table 7.13** Students explain why they like subjects it best

The top four reasons stand out from all the others. The views of students reflect findings from elsewhere. Thus, over 60 years ago, Piaget (1962) noted that young learners were naturally trying to make sense of the world around. This is the natural way of learning - seeking to understand. In the recent work of Jung and Reid (2009) with young adolescents in South Korea, they noted the relationship between being able to understand and holding positive attitudes towards learning in a science.

The first four reasons relate strongly to the findings of Reid and Skryabina (2002) where they observed the reasons which make physics attractive. They found three reasons, two of which related to the nature of the curriculum and the quality of teaching the third relating to career potential.

Major issues are illustrated in this question:

-  The desire to understand, not memorise (consistent with Piaget, 1962);
-  The role of creativity in learning (much emphasised by Robinson, 2010 -);
-  The need to see what is learned as meaningful and relevant (consistent with Reid, 1999);
-  The place for freedom to think.

(5) Think of your recent school experiences.									
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %						$\chi^2$	df	p	
My school is well equipped to help me learn well.	Boys	5	26	38	18	10	4.8	1	< 0.05
	Girls	7	31	35	17	9			
	Total	6	28	35	17	10			
My school does not have enough computers to help our learning.	Boys	28	28	21	14	9	4.6	1	< 0.05
	Girls	21	27	22	19	11			
	Total	25	28	21	16	10			
I like examinations where I have the opportunity to show that I have ideas of my own.	Boys	8	19	32	25	17	17.0	4	< 0.01
	Girls	5	15	28	23	29			
	Total	6	16	30	24	23			
I prefer to learn the facts and then be tested on what I remember.	Boys	25	32	26	10	7	6.1	2	< 0.05
	Girls	21	29	26	14	10			
	Total	23	31	26	12	8			
In order to pass my examinations, I need to study just what the teacher tells me.	Boys	11	16	23	27	23	0.5	4	n.s
	Girls	10	15	23	28	24			
	Total	11	15	23	28	23			
We cannot call anything scientific knowledge unless it is absolutely true.	Boys	39	30	25	4	2	2.6	4	n.s
	Girls	39	30	23	5	4			
	Total	39	30	24	4	3			
I believe it is the job of the teacher to supply me with all the knowledge.	Boys	41	31	15	7	6	3.6	4	n.s
	Girls	44	27	15	10	5			
	Total	42	29	15	9	5			
All I have to do in science is to memorise things.	Boys	15	17	22	28	18	2.6	4	n.s
	Girls	17	17	24	24	19			
	Total	16	17	23	26	19			
My school is preparing me well for later life.	Boys	10	22	34	19	16	5.9	4	n.s
	Girls	15	23	32	17	13			
	Total	13	22	33	18	15			
In exams, I like questions which give me the scope to go beyond what is taught and show my ability to think.	Boys	27	26	27	8	13	14.2	4	< 0.01
	Girls	19	23	26	13	19			
	Total	23	24	26	11	16			

**Table 7.14 Students are thinking of their recent school experiences**

This table reveals a fascinating insight into the student mind in Bahrain. It is amazing that, in a country with the wealth of Bahrain, that students are not convinced that their schools are well equipped and, even more importantly, lack enough computers. They are also not totally convinced that the school is preparing them well for later life. This is a serious issue for it is difficult to be motivated when the purpose and perceived relevance are not apparent. The teachers were somewhat ambivalent on the extent to which quality assurance had improved student educational experience (item 4n).



The other parts of question 5 are related, focussing on what is to be rewarded in assessment and the nature of knowledge. It is sad, but rather similar to what Al-Shibli (2003) found with students aged 15-22 in Oman, that students have a black-and-white view of knowledge, specially scientific knowledge. The whole concept of the hypothetical nature of such knowledge seems almost completely missing.

This may be related to the way they view the role of the teacher in supplying knowledge. This, in turn, may be influencing the way they see examinations as testing their ability to recall memorised knowledge. They do recognise that they have to go beyond what the teacher gives and they seem to be appreciating that studies in the sciences should involve more than memorisation.

On a positive note, they tend to want examination questions which allow them to demonstrate their ability to think, although the girls are less sure here, but they are not sure about generating ideas of their own in examinations.

Overall the picture is given of an educational system where there is a fixed syllabus for each subject, where the role of teachers is seen as transferring information from their heads into the heads of the students and where the examinations have more or less all the rewards for the correct recall of that memorised information. There is a perception that there is a lack of freedom to think, to be creative, even to understand.

(6) Think about the way <i>you like to learn</i> .									
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %							$\chi^2$	df	p
I prefer to learn by reading books.	Boys	14	30	32	15	9	3.0	4	n.s
	Girls	16	25	35	14	10			
	Total	15	27	33	14	10			
I often see ideas in terms of mental pictures.	Boys	37	39	18	3	2	10.2	4	< 0.05
	Girls	43	41	11	3	2			
	Total	40	40	14	3	2			
I like to understand things rather than simply memorise them.	Boys	56	21	15	5	4	1.4	4	n.s
	Girls	55	19	15	6	4			
	Total	55	20	15	5	4			
I like subjects where things are clearly right or wrong.	Boys	32	27	20	11	10	16.8	4	< 0.01
	Girls	25	20	22	17	16			
	Total	29	23	21	14	13			
I find I rely heavily on clear explanations from the teacher.	Boys	30	39	20	6	5	12.6	4	< 0.05
	Girls	38	30	19	9	4			
	Total	34	34	19	8	5			
I learn best when I do things for myself.	Boys	32	33	26	8	2	17.9	4	< 0.01
	Girls	42	30	18	6	5			
	Total	37	31	22	7	4			

**Table 7.15 Students think about the way they like to learn**

There are several remarkable observations from the data in this table. The use of mental pictures stands out. This is consistent with the findings of many who have argued strongly that traditional education seriously hinders those with visual-spatial abilities (Silverman 2002). Education has relied far too much on the symbolic (word and number) while high proportions find knowledge much more accessible using mental pictures. The second strong finding is the desire to understand rather than memorise. Seeking to understand is natural; being forced to memorise is unnatural (Jung and Reid, 2009). Together, these two findings offer a clear message for future planning.

The final two items in question 6 reveal an interesting apparent contradiction. They clearly want to do things for themselves but they rely heavily on teachers for explanations. These need not be contradictory but it is important that teachers offer explanations while allowing the learners to apply the ideas in a free atmosphere. It is also worth noting that girls are slightly more dependent on teacher explanations and also on wanting to do things for themselves.

(7) Here are some reasons for choosing coursing various courses. Students asked to tick <b>all the reasons</b> that are true for them.	
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %	
30	I do not like science subjects.
53	I like learning languages.
40	I think my course will lead to good jobs.
43	I am doing what parents encouraged me to do.
52	I like doing practical things.
57	These subjects are the ones where I gain the best marks.
42	Mathematics is my best subject.
36	My teacher encouraged me.
32	I find the sciences too difficult.
46	The subjects are important for study for my chosen career.
49	I think my course will help me to understand the world.

**Table 7.16 Students asked the reasons that are true for them**

Every reason offered to them is selected by quite high proportions, revealing the diversity of factors that influence curriculum choices. Some are positive reasons, some are negative. Understandably, the power of examination success is seen as a very strong influence while the needs of wider life and careers is important. Their responses for ‘*practical things*’ is puzzling - the meaning of ‘*practical things*’ may not be as intended.

(8) Here are ways you can learn , Students asked to tick <b>two</b> the reasons they think are the <b>most helpful</b> .	
Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %	
27	My teacher lecturing.
37	Reading my textbook.
38	Working at home.
67	Working in a group.
52	Doing practical activities.
60	Questions and discussion with the teacher.

**Table 7.17 Students preferred ways of learning**

The aim of this question was to find out the students preferred ways of learning. Three areas stand out: the highest percentages show for: working in groups, questions and discussion with the teachers, and doing practical activities.

This is consistent with previous observations. The students are recognising that they have minds of their own, they want to think things through for themselves and try things out for themselves. The picture is a gentle revolt against the emphasis on memorising what others decide they need, to do it without thought or question and to do it in an isolated way.

<i>(9) Imagine you were in charge of your entire school.</i>		
<i>Boys: N = 378, Girls: N = 415, Total: N = 793, Data as %</i>		
<i>Suggest one thing you would like to change.</i>		
<b>%</b>	<b>Category</b>	<b>Expansion</b>
<b>9</b>	<b><i>Teacher Behavior</i></b>	Teachers should deal equally with students, teachers should behave well with their students and guide them with flexibility, transparency and in a balanced manner. Teachers should be aware of the precise applications of the educational rules and regulations. Teachers should also avoid discrimination among students, taking into account individual differences. Teachers need some training courses in how to deal with students, especially in how to solve students problems.
<b>5</b>	<b><i>Curriculum</i></b>	Developing curricula based on understanding rather than memorizing and increasing the practical and applied materials with the content. Increasing learning of French language and its curricula. Reducing the contents of the textbooks, because they are long with repetitive information.
<b>21</b>	<b><i>School environment</i></b>	Improving school facilities, developing and maintaining the old buildings, changing and developing schools' cafeterias considering the quality of its food, reducing the number of students in each classroom, providing students with opportunities to express their opinions about teachers and their performance in classrooms, accepting their suggestions about the development, and building a link between them and the school administration, intensifying activities, events and scientific competitions which are related to the subjects, improving the classroom environment and making it interesting for the process of teaching and learning, separating primary and secondary schools from each other.
<b>24</b>	<b><i>Teaching</i></b>	Diversification and improvement of teaching methods with the employment of modern methods in teaching, focusing on the interaction of students with the teachers in the classrooms, paying more attention to the practical and applications in teaching scientific subjects; chemistry, physics and biology, focusing on understanding in teaching and keeping away from the conservation and memorizing methods and encourage students towards self-learning and studying, recruitment of qualified teachers with high efficiency in scientific and educational knowledge, increasing of employment of computers in teaching and learning process, increasing the number of electronically equipped classrooms, Teachers should be examined in a scientific and educational knowledge every three years to develop their performance and determine their needs for training, increase the number of laboratories to carry out scientific experiments for the scientific subjects such as; physics, chemistry and biology.
<b>6</b>	<b><i>Examinations</i></b>	Re-examine the system of evaluation of the final and mid-term tests and daily tasks in terms of grades and marks, increase the degree of practical tests, reduce the short tests and re-arrange them for each subject, students should be informed about their results and performance in a regular base and not wait till their exam papers results appear in order to improve their performance.
<b>5</b>	<b><i>Head teacher related matters</i></b>	Precise application of the rules and regulations of discipline for students and career of teachers, discharge of weak teachers or re-train them. Prevent over absence of teachers and follow them in this matter, change the style of the school administration to be more civilized and developed effective ways of solving students problems.
<b>30</b>	<b><i>No suggestion</i></b>	Some students ignore writing their suggestions due to their carelessly and absence of awareness and guidance to do that.

**Table 7.18 New Ideas**

Their responses generated the categories in the table above and were not pre-determined by the researcher. The suggestions from the students here are very revealing. Of course, they will have ideas for improving the school environment and the way the school is led

by the head teacher. Inevitably, they will have their own ideas relating to the way teachers operate. Some of these may be helpful, some may be unrealistic.

Looking at teacher-student relationships, there is clear evidence that some students are unhappy about the way they have been treated, the idea of unfairness being apparent. They are also asking for teachers to be trained, - more or better. In their eyes, the training needs to focus on human-relationship skills as well as numerous aspects of the teaching process.

In simple terms they want:

- ☒ Greater variety in teaching approaches;
- ☒ Making learning much more related to life (the word 'practical' seems to indicate this);
- ☒ Making the sciences understandable;
- ☒ Moving away from the emphasis on memorisation;
- ☒ Focussing on developing the skills for learning
- ☒ Using laboratories more frequently and effectively;
- ☒ Periodic teacher evaluation

Two other areas receive useful suggestions: the curriculum and the assessment systems. The curriculum is criticised in terms of the continual focus on memorisation and not understanding, its perceived irrelevance, and the overloading of content to be covered. Inevitably, learners almost always show unrest over assessment. However, the way it is conducted is criticised here and there is a strong desire for better feedback to direct future learning.

## 7.6 Important Overall Outcomes

Before turning to the views of educational administrators and school principals, this section offers a summary of some of the main findings as revealed by the surveys of teachers and students.

Much of what the learners showed was quite positive but the focus here is on a few aspects which point to an agenda for the future.

When asked about what the school shows them to do, the students tended to see memorisation as dominant over understanding:

*School shows me what to memorise* 26 14 23 15 10 11 *School shows me what to understand*

In the Kingdom of Bahrain, students attend single sex schools and the differences show in this question (table 7.19). Thus, perhaps the teachers in the schools for girls do not emphasis memorisation quite so much:

<i>School shows me what to memorise.</i>	<i>Boys</i>	24	18	23	18	9	8	<i>School shows me what to understand.</i>	$\chi^2 = 20.6$ (df5)	p < 0.001
	<i>Girls</i>	28	11	24	12	11	14			

**Table 7.19 The memorisation-understanding issue**

The memorisation theme recurred in another question:

*I like to understand things rather than simply memorise them.* 55 20 15 5 4

This is almost a cry of desperation, and reflects what is the natural way of learning. Seeking to understand is natural; being forced to memorise is unnatural (Jung and Reid, 2009).

When asked about their preferred way of working, there was a very strong preference for working collaboratively:

I prefer working on my own. 12 6 10 10 14 47 I prefer working with others.

In life, people tend to work in collaboration with others and there is a need for schools to reflect this more in the way they work.

This was supported by an interesting reaction to what they saw as the most helpful ways of learning. Students were asked to tick two reasons (from a list of 8) that they thought are the most helpful for their learning. Their top two choices were:

- 67 Working in a group.
- 60 Questions and discussion with the teacher.

In another question, students were asked to indicate their preferred ways of working. In one question, the use of mental pictures stands out:

I often see ideas in terms of mental pictures.      40    40    14    3    2

This is consistent with the findings of many who have argued strongly that traditional education seriously hinders those with visual-spatial abilities (Silverman, 2002).

The sciences have a high profile in education in the Kingdom of Bahrain. They were asked how they felt about the sciences and most did not support this time allocation.

There was not enough time in science.    9    8    13    15    15    40    There was too much time in science.

The way they see the sciences is somewhat frightening:

We cannot call anything scientific knowledge unless it is absolutely true.      39    30    24    4    3

Maybe this offers a clue to what is unappealing about their studies in the sciences.

Later, they were asked about subject popularity. Mathematics, biology and accounting stood out as highly popular. By contrast, chemistry and physics did not perform at all well in the popularity stakes. Is the popularity due to the curriculum, the way of teaching or the way of assessing, or some combination of these and other aspects? This needs explored.

The arts areas do not have such a prominent role in the schools as the science subjects but they were asked about their performance in arts subjects:

*My best marks came in arts subjects* 21 13 17 16 10 23 *My worst marks came in arts subjects*

This suggests that this broad area of the curriculum was about right in terms of difficulty.

The questions moved on to look at why subjects were their favorites. These four reasons stand out from all the others.

32 *Understandable, made me think.*

22 *Creative and enjoyable teaching.*

18 *Easy to learn.*

11 *Teaching method effective.*

Thinking of assessment, there is a nice example of the tensions that students at this age often show. On the one hand, the security of factual knowledge shows clearly:

*I prefer to learn the facts and then be tested on what I remember.* 23 31 26 12 8

On the other hand, they tend to want examination questions which allow them to demonstrate their ability to think:

*In exams, I like questions which give me the scope to go beyond what is taught*

*and show my ability to think.* 23 24 26 11 16

The importance of the teacher in the eyes of the school students is seen in their responses to this question:

*I believe it is the job of the teacher to supply me with all the knowledge.* 42 29 15 9 5

When asked about the resources in the school, there was general acceptance of their adequacy but they did express the view that they wanted more access to computers.

However, when asked about the relevance of school to their needs, the picture was more ambivalent.

*Work at school is relevant to my needs.* 13 12 22 20 13 19 *Work at school is irrelevant to my needs.*



Of course, at age 18, they may have some ideas about their future areas of study or possible places of work. However, they will not yet be aware of how what they have learned may or may not be of value in the future.

The final question invited them to imagine they were in charge of their school and asked what one thing they would change. Interestingly, nearly one third offered no ideas at all. However, about one quarter focused on aspects of what actually goes on in the teaching situation, some of the frequently mentioned points being:

- More variety in teaching methods;
- Focussing on the interaction of students with the teachers in the classrooms;
- More attention to the practical and applications in teaching science subjects;
- Focussing on understanding and avoiding memorising methods;
- Encourage students towards self-learning and studying;
- More use of computers, with an increase in electronically-equipped classrooms;
- More laboratories and more use of them in the sciences.

Teachers were offered a range of descriptions which reflected the purposes of quality assurance procedures and were asked to tick the three that they saw as most important. It is interesting that they selected those aims which reflected an emphasis on improvement more than twice as often as those which reflected accountability.

There was a repeated cry for training for teachers. In considering developing quality, two thirds asked for on-going training while one third wanted it at the outset. There was a consistent picture where the teachers clearly thought quality in all they did was vitally important but were not totally convinced that current procedures were optimal. Indeed, they overtly asked to be trusted! There were quite marked differences between men and women, with the women being consistently more positive.

Perhaps it best summed up by their responses to this question (Table 7.20):

The quality assurance system has improved the educational experiences of my students.	<i>Men</i>	9	29	27	22	13	$\chi^2 = 14.9$ (df4)	p < 0.01
	<i>Women</i>	9	36	32	16	8		

**Table 7.20 Quality assurance and improvement**

## 7.7 Discussion and Conclusions

The key deductions from the two surveys are summarised in table 7.21.

	Deduction	Comment
<b>Learners</b>	Want understanding, not memorising	Consistent with Piaget (1962)
	Question relevance of curriculum	Follows arguments of Reid (1999, 2000)
	Say curriculum is overloaded	As knowledge expands, curricula expand
	Want a wider range of teaching approaches	The whole area of learner characteristics (Hindal, 2007)
	Want scope to work collaboratively	Consistent with Reid and Yang (2000)
	Want assessment overhauled	This is a major area for it appears that national assessment are rewarding recall and distorting teaching and learning
	Want assessment to allow scope for thinking	
	Want to learn how to learn	Better carried out implicitly - but teachers need trained
	Want to have scope to think, especially creatively	Consistent with Robinson (2010)
	Want greater emphasis on visual learning	Consistent with Silverman (2002)
	Want better teacher-student relationships	They always do!
	See too much time spent in the sciences	An interesting insight
	Want the sciences to be understandable	How to do this is known (see Reid, 2009, 2010)
	Want better use of laboratories in the sciences	Consistent with Hofstein and Lunetta (1982); Hofstein and Mamlok-Naaman (2007)
	Periodic teacher evaluation	It seems current QA does not work!
<b>Teachers</b>	Want to develop high quality education	This is to be expected
	Want emphasis on improvement in quality assurance	This is widely held (Al-Madani et al., 2012)
	Want to know <i>how</i> to improve things	Vague generalisation are inadequate
	Are desperate for more training and development	This could be met: but who does the training?
	Question current quality assurance procedures	Is there any evidence that QA ever improves quality?
	Want to be trusted, affirmed and supported	Consistent with Humes (2012)

**Table 7.21 Summary of Findings**

The observations in table 7.21 offer a clear agenda for addressing quality issues in secondary education in Bahrain.

## **7.8 Interviews with Senior Staff in Education**

In this study, the learners and their teachers have been surveyed. It is now necessary to look at the views of those in various levels of education leadership. With much smaller numbers, interviewing was considered more appropriate.

### **7.8.1 Methodology**

The key groups to be interviewed included Leaders in the Ministry of Education, Leaders in the Quality Assurance Authority, Head Teachers, Specialists in the Ministry of Education and Quality Assurance Authority. The aim was to gather information about the effectiveness of the Quality Assurance in their own words and to gain further insights into the way the Quality Assurance system work was seen. The total number interviewed was 23. They were interviewed individually and the time for the interview lasted about 30 minutes for each person. All questions of the interview are shown in appendix (2).

The interview explored several different areas but it has to be remembered that the interviews were planned to give respondents opportunities to express views which may be based on their work or commitment rather than shortcomings in the Quality Assurance experience.

The interviews covered eight areas but discussion were kept open and flexible, to allow respondents to offer their own insights. The interviews were recorded (using solid state technology which fed directly into a computer afterwards). Permission was gained from each interviewee in advance of the interview.

The responses were summarised from the recordings. They were then analysed to look for common themes. The aim here was to look for the key views that they expressed

and to look for any common patterns across several interviewees. In some cases, it was possible to see responses in terms of percentages who all held similar views. However, in many areas, the summary following is qualitative, giving a picture of diverse views. There is, of course, no certainty that the views expressed reflected reality. This is not to suggest any element of dishonesty. However, it is quite possible that many were expressing views that reflected their aspirations rather than what was actually happening. Danili (cited in Reid, 2011) described this as the '*reality-aspiration problem*'.

No attempt was made to compare the views of the educational administrators quantitatively with the perceptions gathered in the questionnaires which had been used with teachers and students. However, it is possible to see clear patterns of differences qualitatively.

The findings from the interviews are now summarized.

## **7.9 Interview Findings**

### **(1) What you think is the main aim for quality assurance?**

Those who were interviewed consistently saw the main aim for quality assurance in education in terms of improvement. They wish to improve school performance and educational outcomes, advancement of the educational level and dissemination of culture of evaluation and self-evaluation in educational organisations. They saw this in terms of making an impact on the labour market in order to achieve the vision of the Kingdom of Bahrain for 2030 (Our vision, undated). With such developments, they assumed Bahrain will become one of developed and advanced countries in the world.

Although they argued for improvement, in practice, school evaluations are used almost entirely in terms of accountability. In Bahrain, school performance is seen in terms of

organisation and efficiency and not in terms of educational outcomes as the documentation used by the Ministry shows clearly (see appendix 5). Although they spoke of educational outcomes, the quality assurance procedures in Bahrain tend to leave the outcomes very vague, with too much emphasis on examination performance. It is very difficult to relate what goes on in schools to the labour market simply because it takes years for any connection to become apparent.

## (2) Describe your role in quality assurance at secondary school stages

As might be expected, answers varied from person to person and each group of respondents offered answers in line with their responsibilities. Indeed, the various groups did not use the same language as each other and it was clear that they saw quality assurance differently.

The following themes were raised in the most frequently given responses:

Responses	Comments
Attend training programs that are needed in quality assurance in education.	Is there any evidence that the training helps? The teachers are desperate in seeking it.
Concentrate on the follow-up the process of teaching through classroom visits.	Any visit alters classroom dynamics - will such visits be useful?
Investigate the performance of the school in general (school administration, and relations between teachers and the teaching process).	Basically, looking at organisational efficiency
Apply the self-evaluation system in the school and distribution of its culture.	Self- evaluation may be a useful way forward
Apply international quality assurance programs in education in their schools.	Any evidence that international quality assurance programs exist and are valid?
Survey the views of parents in the process of teaching and quality.	Useful but time-consuming. There is little evidence that such consultations actually take place.
Implement workshops about the dissemination of quality assurance culture in the school.	Is there any evidence that the workshops help? The teachers are desperate in seeking training.
Focus on how to implement collaborative learning in the teaching process.	Collaborative learning may be desirable but how can a classroom visit show its effectiveness?

**Table 7.22 Roles in Quality Assurance**

**(3) Describe how you see the strengths and weaknesses of the present system.**

There was broad agreement in the responses given across all groups of respondents.

This can be summarised (table 7.23):

Respondent Comments	Comment
<b>Strengths</b>	
A Royal Decree built a quality system in education. This has given a measure of national coherence and consistency, allowing the process to be modified in the light of international developments and internal needs.	Will give national coherence and consistency but can it be adapted flexibly?
The focus is on the performance of teachers in the teaching process in the classroom or the teaching itself.	The focus is inappropriate for it ignores curricula, assessment and resource issues (all outwith teacher control)
Teaching and learning processes became more student centred and teachers roles converted to be as guidance and advisors of their students.	It is clear that this goal is NOT being met
Quality assurance system motivate all schools for the best performance, and focussing on the follow up of students in the classrooms and enthusiastic schools to compete to develop education to reach the international standards.	The evidence suggest de-motivation rather than motivation, a lack of clarity and lack of confidence to make changes
External teams from outside the school participate in assessment of teacher's performance.	Danielson (undated) shows this NOT the best way forward - it is fundamentally flawed
Unlimited and continuous support from all the leaders in the Kingdom in quality assurance of education as well as inclusive workshops and training programs from the international experts and companies: a continuous and constant process.	Clearly, this goal is NOT being met.
International standards have been used for the evaluation and assessment of educational system.	There is NO known way to define and measure international standards
There is a continuous communication between the Ministry of Education and The Quality Assurance Authority.	This goal is NOT being met.

Respondent Comments	Comment
<b>Weaknesses</b>	
The evaluation period to visit the classroom and teaching situation are only three days for a group of teachers in a school is very short and not sufficient to assess and for adequate decision-making and giving sound judgments.	True but any outsider changes the classroom as so as they enter, making any observations of limited value (Danielison, undated)
Some reviewers and evaluators for the schools are deficient in their educational experiences in teaching and assessment. They also lack in ability to gain the confidence of the field of education especially from teachers and school administrators in their evaluation.	There has to be credibility. In other words, those who conduct quality assurance must have an established and up to date track record of excellent performance in whatever they inspect: Cox (2004)
Some evaluators or reviewers to the schools visit classrooms of a different specialization and this does not give credibility to the evaluation.	A major credibility issue

**Table 7.23 Summary of Strengths and Weaknesses**

**(4) What is your experience of training in the context of quality assurance?  
Is it important, essential or what?**

Two general issues were identified frequently:

- (a) Everyone emphasized the importance of continuity of the training process in quality assurance for all groups by the Quality Assurance Authority as well as by the Ministry, and that training programs should concentrate on practical, applied aspects and lead to increase the efficiency of evaluators. These programmes should be carried out by the universities and international experts in quality assurance.
- (b) Most of the principals confirmed that the training programmes which have been carried out are inadequate both in terms of frequency and competence. There is lack of follow-up on implementation in order to develop and improve them. There is a lack of the mechanism of the implementation of these programmes between the Authority and the Ministry. It was felt that the programmes should focus on the evaluation standards and how to implement the process of the evaluation.

**(5) How did you find the user guide? What are its strengths and weaknesses?**

Answers to this question were completely inconsistent across the groups. Thus, those in the Ministry or the Authority saw things in positive terms: there was guide book of the procedures and there is an explanatory note and detailed minutes were distributed to all schools.

However, it seems that school administrators do not read these documents, or do not grasp what they were saying or, indeed, some were even unaware of their existence. There was a strong view that the documents were set out in terms that were far too vague and general. They lacked clear performance indicators. It was felt that evaluators varied in their interpretation and this gave no credibility to the whole process. The principals also stressed the need to provide the evaluators with an integrated guide book for the system with detailed explanations for the guide book and its mechanisms to include the roles for both sides, the Ministry and the Authority, with training provided for both of them.

**(6) In the past, there was no quality assurance. What changes has the introduction of quality assurance made? Are these beneficial or otherwise?**

There was general agreement that quality assurance was an important and valuable aspect of educational provision (table 7.24):

Respondents Comments	Comments
Opinions were expressed that schools and teachers might become motivated to do their best. Headteachers would be motivated and inter-school competition would raise standards	There is no evidence in the literature that competition generates motivation and much anecdotal evidence that suggests it does the reverse
The quality assurance system has led to many positive changes in schools through the development and follow up teams. There are efforts in order to distribute the culture of quality in schools and focus on the self-evaluation.	The teachers do not support these assertions.
Some stressed that the the direction of change is unclear. Time is needed for the process to settle down. Its actual impact will be clear if there are continuous training programmes and workshops, and these should be presented by international experts in quality in education.	The training does not seem to have worked. Who are these international experts in quality in education - for other countries show little evidence of success by this kind of approach?
Quality assurance offices have been opened in each school. These offices are followed up from the principals of the Ministry to make sure that the implementation of quality measures are done in order to develop and improve the performance of schools in all aspects, especially in teaching and learning process.	Is there any evidence that such offices do anything more than act as a centre for handling the bureaucracy?

**Table 7.24 Changes arising from Quality Assurance**

**(7) Suppose quality assurance was now removed. What differences would you notice?**

While everyone felt that a quality assurance system should not be removed, many felt that it needed major modification. There was a need for on-going development so that the Kingdom of Bahrain would move forward to becoming a developed and advanced country in the field of education in the world. It was felt that removal of the system might lead to:

- Decline of interest in the quality of education and reduction of competition between schools to access to better education.
- The idea that the quality system in education has failed and this negatively affects on society.
- Schools failing to follow-up and reduce of the desire for development and improvement in education.

However, the interviewees offered no evidence to support the above list. It seems that the leaders simply want it all to work.



**(8) Talk about quality assurance as it affects on each of the following aspects**

The respondents were given free opportunity to talk openly and there was remarkable degree of common ground in the comments made.

***The curriculum***

Everyone stressed that the quality assurance system has not yet had an effect on the curriculum and textbooks. They also confirmed the need to link the quality of education with the curriculum and textbooks as these control much of what is taught.

***Students' Achievements***

Most of the stakeholders appear to emphasize that the impact of quality assurance school operation on students' achievement is very slow. They all agreed that quality assurance should have better effect on the students' academic results. They also added that it is only when the students' improvement is tangible that it will be possible for them to advance that quality assurance has been useful and efficient.

**Quality of Resources**

All stressed that there is no clear link between the quality assurance system and the learning resources centres. There is only an exploratory visit to these resources.

***Quality of teaching***

All of them stressed that they felt that there had been a clear impact of the quality assurance system on learning and teaching processes as well as the follow-up of teachers from all school principals. They also emphasized the need for continuous training in quality of teaching for teachers. However, is there any evidence that teaching

has changed in any substantive way? Indeed, is there any evidence that quality of teaching is the key issue? The survey data suggest otherwise.

### ***Quality of school leadership***

All of them stressed that there is a clear impact of the quality assurance system on the school administration and there is a follow-up of head teachers' performance. They felt that this is one of the benefits of quality assurance system.

## **7.10 Gaining on Overall Picture**

The interviews relate to research question

(1c) How is quality perceived by educational administrators who carry responsibilities in relation to secondary education in Bahrain?

It is very evident that the pictures painted by the students, their teachers and those in educational leadership are very different. In particular, the educational leadership stand out in offering very different perspectives. It is, therefore, obvious that there is little shared agenda other than an overall wish for educational quality, but what is meant by this is not even clear. There is a clear message that the educational leadership needs to consult and listen more to teachers and students if any shared agenda is to be reached. Perhaps, the teachers have a better insight into reality while the students must take a central role in that the schools are there for their benefit.

### 7.11 An Agenda for Action

This survey has revealed some key areas for further exploration and these are problems which may well be generic in all school systems in varying degrees:

- (a) While the schools (and examination system) emphasise memorisation, the learners want to understand. This can only be addressed by re-examining the national curricula and the way national examinations are set.
- (b) There is a need to look closely at group-work and how group-work tasks can be incorporated into the curriculum.
- (c) The whole area of the visual-spatial needs re-considered.
- (d) The amount of time devoted to the sciences needs considered as well as the way the sciences are presented.
- (e) There are opportunities to re-examine curricula and teaching approaches to see the extent to which these encourage thinking, challenge and creativity.
- (f) The national examination systems needs re-examined: how do we balance the security of factual knowledge with the desire to express ideas?

In fact, the survey has not revealed any evidence that the quality assurance system has made (or indeed, seeks to make) any impact in improving the curriculum (where perceived overload and irrelevance dominate), the assessment system (where recall seems to dominate) and the resource levels (for example, teachers are calling for training)

These six issues above may well be important issues for quality in many countries. However, the study shows that it is possible to gain useful insights by asking the learners directly to look back on their experiences and this may be a fruitful (and economic) way to move forward. The study is now looking at ways by which some of these issues can be addressed. The big question always has to be whether the procedures of quality assurance have improved quality. The answer to that is far from clear and may be one of the biggest questions for education in the 21<sup>st</sup> century.

## Chapter 8

### National Assessment in Bahrain

#### 8.1 Introduction

In chapter seven, one of the recurring features from the survey of the students related to memorisation. Many learners felt that the schools showed them what to memorise and they tended to see memorisation as dominant over understanding. Indeed, there was evidence that they wanted the freedom to think and to understand. Assessment probably holds the key to all this, for students and their teachers will focus on the skills which gain the greatest rewards in the assessment system. Furthermore, the way schools see assessment is, inevitably, strongly influenced by the national examination system. This chapter looks at some aspects of the assessment system in Bahrain. In Bahrain, assessment is almost entirely summative and, therefore, the discussion here will focus only on this area of assessment.

#### 8.2 Bahrain's Assessment System

Assessment has been defined by Angelo (1995) as,

*“An ongoing process aimed at understanding and improving student learning. It involves making our expectations explicit and public; setting appropriate criteria and standards for learning quality; systematically gathering, analyzing, and interpreting evidence to determine how well performance matches those expectations and standards; and using the resulting information to document, explain, and improve performance.”*

Other descriptions for assessment exist (eg Palomba and Banta, 1999; ABET, 2003). There is a strong agreement that the focus of assessment should be on the quality of student learning. However, there are many ways to assess and many purposes for assessment. These are now reviewed very briefly.

In a more formal sense, assessment is the process of gathering, interpreting and using evidence to make judgements about the achievements of students in learning. The evidence can be gathered by looking at what students say, write or can do. Sometimes, useful assessment insights can be gained from teacher's reports, gained from observation of progress and performance in class. However, assessment tends to look at the '*product*' at the end of a piece of work a module or a course. Nonetheless, it is equally possible to look at the experience of learning itself.

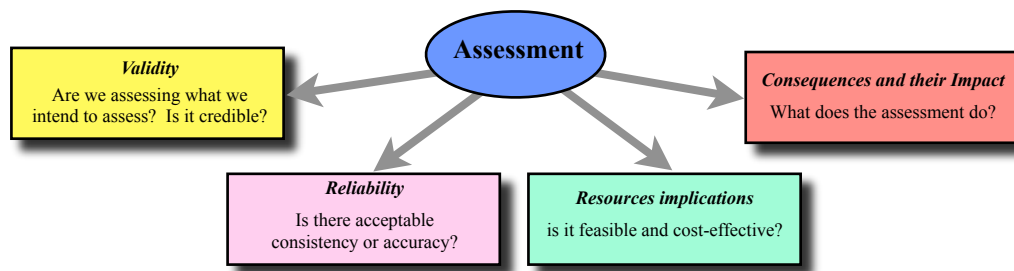
Assessment information can be used in numerous ways, including:

- (a) To see how well have the learners done
- (b) To see how well have the teachers done
- (c) For certification at the end of a course
- (d) For selection for future opportunities
- (d) For directing future learning
- (e) For monitoring and accountability

The problem lies in the fact that assessment designed for one purpose may be highly misleading if used for another purpose. Thus, it is difficult to use assessment data designed for certification as a guide to pinpoint strengths and weakness and thus direct future learning. Equally, much assessment data is designed for certification or to give evidence for further study (eg at university). To use such data to rank schools on their educational performance will be utterly misleading in that there are numerous other factors which may influence school performance and these may be much more powerful.

There is a danger with all assessment. It tends to reward those skills which are easy to measure. It tends to neglect those skills which are difficult or impossible to measure. At a national assessment level, this has a '*backwash*' effect, encouraging schools to focus on what is to be measured, thus neglecting other, often more important skills, which are not to be measured.

There are four aspects of assessment which are important, illustrated in figure 8.1:



**Figure 8.1 Important Aspects of Assessment**

The problem is that it is very difficult to be sure what is being measured for the learners have found all kinds of creative ways to obtain ‘*correct*’ answers, many of which depend on recall. However, under sensible test conditions, consistency and reliability are usually assured although inter-marker reliability is a major issue in some subject areas (Hayward and Spencer, 2006). Resource implications may be important. For example, to test skills of verbal communication in a formal examination may require one examiner for each candidate. This is not a feasible option.

The way assessment is used may be a real area of hindrance in learning. Outcomes can block future opportunities while assessment can generate knowledge reproduction and social reproduction. Indeed, testing can be used to control the curriculum and learning while tests can force a focus on test content, training students to the tests, practicing tests, and transmission styles of teaching. Of course, tests and examinations can generate student anxiety and loss of self-esteem. The students may only learn what is to be tested and there can often be a loss of student enjoyment in the process of learning.

There is a strong tendency in most countries only to trust the data from national examinations and to distrust teacher assessments. In fact, the evidence shows that teacher assessment are often very robust and, indeed, a combination of teacher assessment and national examinations is known to give the best data (Assessment Reform Group, 2006).

Thinking of the data obtained, there is a major fallacy to be seen in many countries: it is thought, in general, that examinations give absolute measurements. Thus, a score of 80% means that 80% is known, or a score of 50% means a 'pass'. This, of course, can never be true. If an easy paper is set, the marks will be high; if the paper is more demanding, the marks will be lower.

Examples of this fundamental misunderstanding occur in many countries each year when the national examination results are published. Thus, a newspaper may well speak of improving standards because 72% passed some examination when, in the previous year, 71% passed. The reporter ignores the fact that pass marks are decided subjectively.

A similar problem occurs when some examiners award very high marks, suggesting that the students in their subject are doing well. In simple terms, marks mean absolutely nothing. Any examination is like a measuring scale, where the scale is not marked on it. Examinations merely place the candidates in an approximate order of merit.

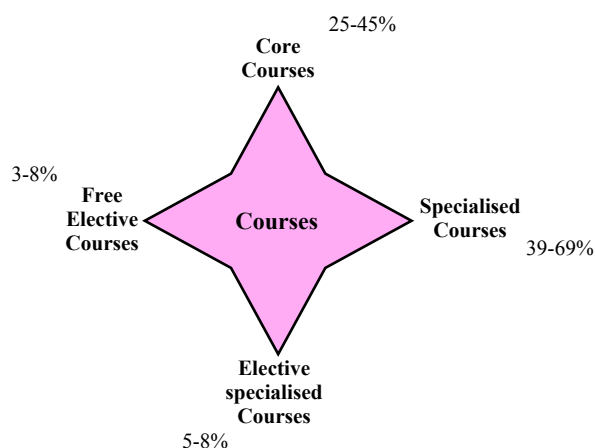
With national examinations, the sample size is usually very large and, in almost every case, the standards will be the same from year to year. Thus, if 70% passed one year, then, unless there is clear evidence to suggest otherwise, approximately 70% should pass the next year.

Of course, it is possible to use assessment formatively, to reveal the strengths and weaknesses of students and, thus, direct further stages of learning. This may give evidence on how educational programmes are working and to determine whether they are contributing to student growth and development. It focuses on programmes rather than on individual students. It provides information on whether the curriculum as a whole provides students with the *knowledge*, *skills* and *values* that leavers should possess in accordance with its mission, set goals and learning objectives. Assessment is a means of discovering what, how, when, and which students learn and develop the

expected learning outcomes both inside and outside of the classroom (Maki, 2002). However, this use of assessment is very different when compared to national examinations and, indeed, the kind of questions asked will be very different.

In Bahrain, school students enter secondary schools (ages 15-18) on condition that they have passed the Intermediate School certificate or its equivalent. Secondary education is seen as the preparation for higher education or the labour market. There are three types of secondary schools: those pursuing a science curriculum, a literary curriculum, or a commercial curriculum. Students are able to change tracks depending on the common courses among more than one specialization. The entire system is based on 6 semesters over the three years and a total of 156 credit hours are to be completed overall. Examinations are set nationally for each age group. DENRB (2008) MoE in the Bahrain has tried to foster the techniques of formative assessment but the system is dominated by national summative assessment.

The credit hours are divided into four groups of courses as follows:



**Figure 8.2 Course structures**



### 8.2.1 Teaching Methods of Secondary Education in Bahrain

MoE (2012) state that the secondary schools use the teaching methods adopted by the Directorate of Curricula, derived from educational philosophy (although they do not state which philosophy). These methods are based on the student's activity to achieve the objectives of the courses (mastery of the process of learning, co-operative learning, self-learning and group learning). It has to be noted that there is absolutely no evidence that all these claims are true, based on all the survey data described in chapter 7.

MoE (2012) go on to say that the Directorate of Curricula is responsible for the comprehensive process of curriculum development. This includes planning and providing study programmes and syllabi for all educational levels and types in public schools, as well as planning innovative curricular projects, and piloting, implementing, evaluating and analyzing results. It also includes making decisions concerning the development of secondary education curricula, and the introduction of the new assessment system in basic education.

It is interesting to note that all these assertions relate to developments outside the schools and yet the quality assurance procedures focus on schools, and specifically on teaching. There is a gross inconsistency here in that teachers (even head teachers) have no input into this process but the teachers and schools are then judged on how well it works out in practice.

MoE (2012) state,

“The following principles have governed curriculum development in Bahrain:

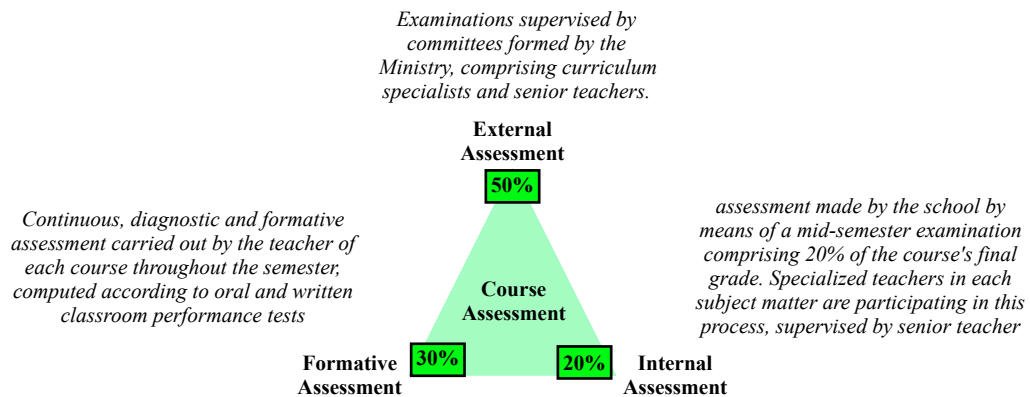
- 🌐 *Curriculum development should be geared towards the future prospects for Bahrain and the major issues of the Arab world.*
- 🌐 *Curriculum development should take into account the latest educational and psychological research.*
- 🌐 *The improvement, renewal and piloting of curricula should be based on continuous field studies.*

- *The curriculum should aim to enable the learner to comprehend modern sciences and to raise her/his technical competency both theoretically and practically.*
- *The curriculum should be flexible and innovative.*
- *Self-access learning should be encouraged through access to educational technologies such as computers, the internet and multimedia.*
- *The roles of government sectors and society should be clearly specified to ensure interaction, harmony, and collaboration with the education sector”*

These principles tend to bear very good insights for the future of Bahrain. However, their implementation in the current working environment is fictional as they tend to be vague and to a certain extent inappropriate. Indeed, from the results obtained in this research, national examinations rely greatly on memorization, and this contradicts with the main principles stated above.

### 8.2.2 Secondary Education Assessment in Bahrain

The system since 1993/4 is:



**Figure 8.3 Assessment System**

Everything is based on percentages and high scores are valued, it being thought that these indicate high levels of success. In fact, it is more likely that the tests and examinations are too easy, largely reflecting recall. The weaknesses of the current system are revealed in considering a more sound system, in the next section.

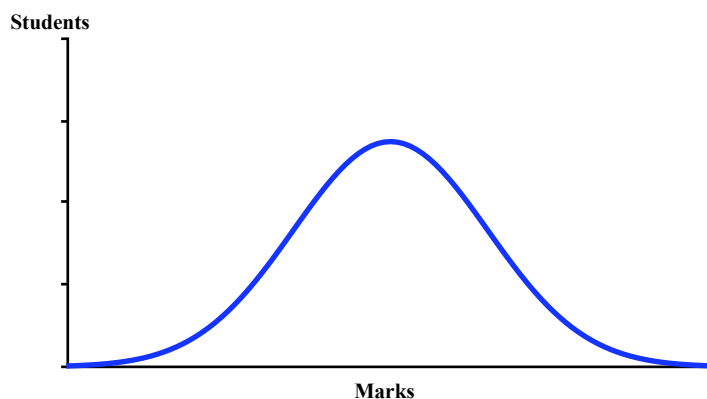
### 8.3 An Examination of Examinations

Before looking at the data from the Bahrain examination system, this section very briefly outlines some of the key features which might be expected from a national examination system.

Any national examination system must fulfil quite a number of purposes. For example, national awards may serve the following purposes:

- ☒ Recognising and rewarding what has been achieved over a sustained period of time;
- ☒ Reflecting accurately the agreed goals for the curriculum;
- ☒ Determining eligibility to enter higher education, and other career opportunities;
- ☒ Revealing specific skills and areas of achievement.

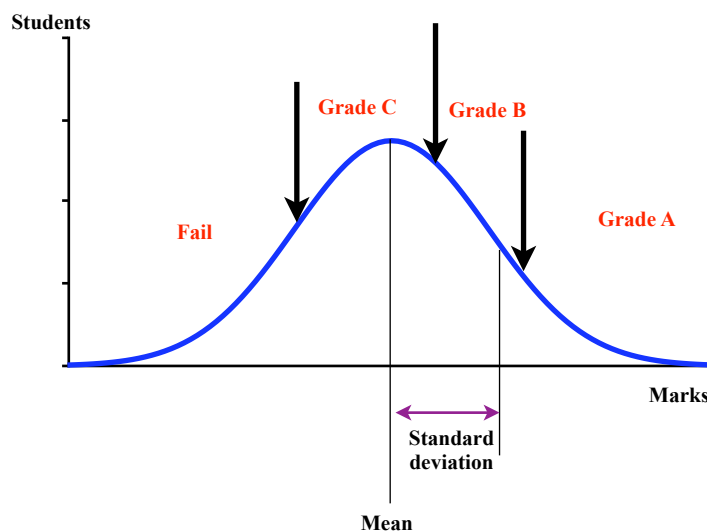
Examinations usually generate marks. Marks mean very little for they reflect the demand level of the specific examination paper. National examinations involve large numbers of candidates and it is possible to use the marks to place the students in a rough order of ability set against the criteria being measured in the particular examination. Thus, marks in any specific subject will generate a distribution that will be close to normal (figure 8.4).



**Figure 8.4 Normal Distribution**

The point on the curve which corresponds to the pass mark can only be determined by human judgement. Thus, the percentage gaining a pass is entirely dependent on the

professional judgement of humans. Given a large number of candidates (perhaps about 1000 or more), then it is reasonable to expect approximately the same proportion to pass in successive years in any national examination. Thus, if 70% of the candidates passed last year in a specific subject, it is likely that a very similar proportion will have the similar abilities the following year and, therefore, deserve to pass. Figure 8.5 illustrates a possible way to allocate grades:



**Figure 8.5 Awarding Grades**

In both figure 8.4 and 8.5, there is no scale on the x-axis (marks). The question is what kind of graph should a good examination generate?

Firstly, the examination should be of appropriate difficulty. Thus, the mean should not be far from 50%. However, a mean of 50% means that half the candidates will gain marks less than 50. This will make these candidates feel *'failures'*. Therefore, a mean of nearer 60% might be more appropriate.

A good examination should distinguish the really good students from those are good, the good from those who are not so good and so on. In other words, there should be the greatest spread of marks possible. The very able students should be able to show their greater ability and that should be reflected in very high marks. Equally, the good and

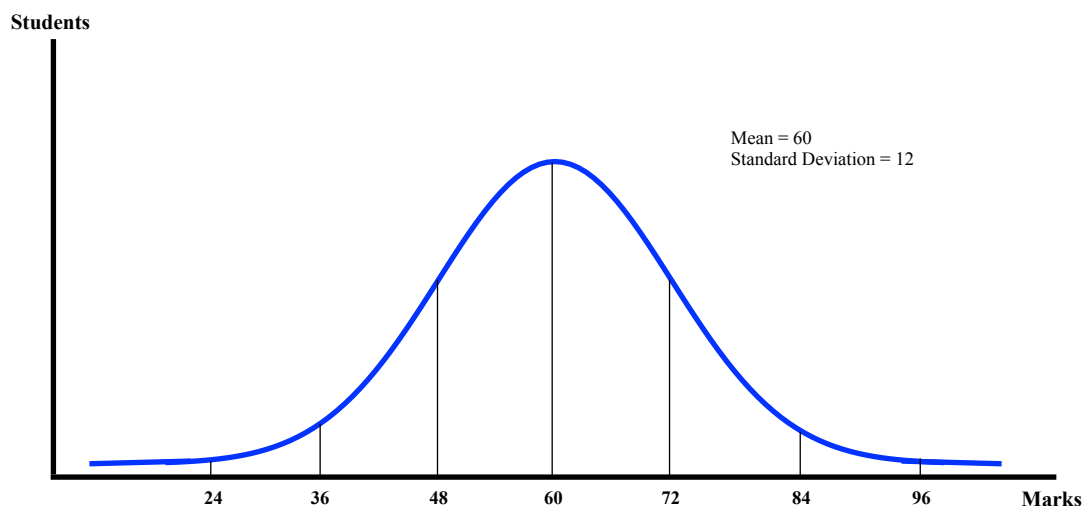
average students should not be deluded by over-high marks. Thus, the marks distribution should have a high standard deviation. However, too high a standard deviation may leave the poor candidates with very low marks and this may create a loss of morale.

Looking at all the factors, it might be said that an ideal national examination should have something like:

$$\text{Mean} = 60 \pm 5$$

$$\text{Standard deviation} = 12 \pm 3$$

This type of distribution will discriminate well but will not place too many learners in the category of very low marks, create a loss of morale. This is illustrated in figure 8.6.



**Figure 8.6 'Ideal' National Examination Marks Spread**

In figure 8.6, only 16% of the candidates will score less than 48% while only 2.5% will gain more than 84%. This does not demotivate too many candidates while allowing the most able to show their abilities.

The above discussion has looked at examinations in any subject. The other aspect is what a *specific* examination in a *specific* subject actually measures. Of course, the content will vary from subject to subject. However, the skills will also vary. Thus, an

examination in, say, a language might be expected to offer evidence of linguistic and literary skills and that will be very different from an examination in mathematics which might be expected to reflect logic-deductive skills, for example. In turn, the skills measured in a chemistry examination will be different from both mathematics and languages.

This can be explored by looking at inter-subject correlations. These will be positive (candidates tend to have all-round abilities) but the correlations should not be too high, reflecting the fact that the various subjects should be rewarding credit for *very different* kinds of skills.

#### **8.4 Methodology**

The survey of students revealed that they seem to perceive problems with the assessment they have experienced. The picture is, inevitably, not totally clear cut. The students say that they want freedom, freedom to show what they understand rather than recalling memorized information. However, there is a natural insecurity in seeking to move into a different way of being assessed. It seems that they want the freedom to think but are almost scared about what this might entail. In simple terms, they want the freedom to show their wider skills but are almost scared about what this might entail.

National examinations determine how teachers will assess in schools. Indeed, national examinations will determine the priorities in that what gains credit in such examinations will become the focus of teaching and of learning. Thus, if there are perceived problems with assessment in Bahrain secondary schools, then it is highly probable that this reflects the way the National examinations are operating.

This was explored by looking at the 2011 final national examination data from Bahrain.

There are four curriculum pathways in Bahrain secondary education, three of them involving both boys and girls. These three main curriculum pathways (science, literary, commerce) are considered separately and the uneven numbers reflect student choices of pathways. The examination authorities were approached (letters in appendix 6) to gain access to the data for the year 2011. This involved 7022 students (the entire population in the three curriculum pathways). The data was made available as raw marks (as percentages) on three spreadsheets. In Bahrain, examination performance is normally given in the form of raw percentage marks.

Thus, the data include all Bahraini students in 2011 and all core subjects are included in the three curriculum pathways. The data were transferred electronically into SPSS for analysis.

The analysis involved looking at means, standard deviations and inter-subject correlations (Pearson correlations for the data are approximately normal). A Principal Components Analysis with Varimax Rotation was run on the data and the scree plot examined. This will reveal how many factors (components) are needed to explain most of the variance in the data (a minimum of 70% was set). Statistical details are offered in appendix (4).

## 8.5 Science Schools

### *Factor Analysis*

The scree plot gives only one factor, accounting for 75% of the variance (a second factor accounts for only 7% of the variance). This one factor almost certainly has to be recall and, indeed, looking at the examination papers reveals how the recall of information is all that is required in all subject areas. Table 8.1 shows the factor loadings.

Science Schools (N = 1333)			
Subject	Factor Loadings	Mean	Standard Deviation
Arabic	0.87	85	9.7
Mathematics	0.90	73	17.7
Biology	0.90	89	10.3
Chemistry	0.92	79	14.5
Physics	0.93	80	12.8
Social Subjects	0.86	92	9.1
Islamic Studies	0.84	94	7.5
English	0.73	78	15.5

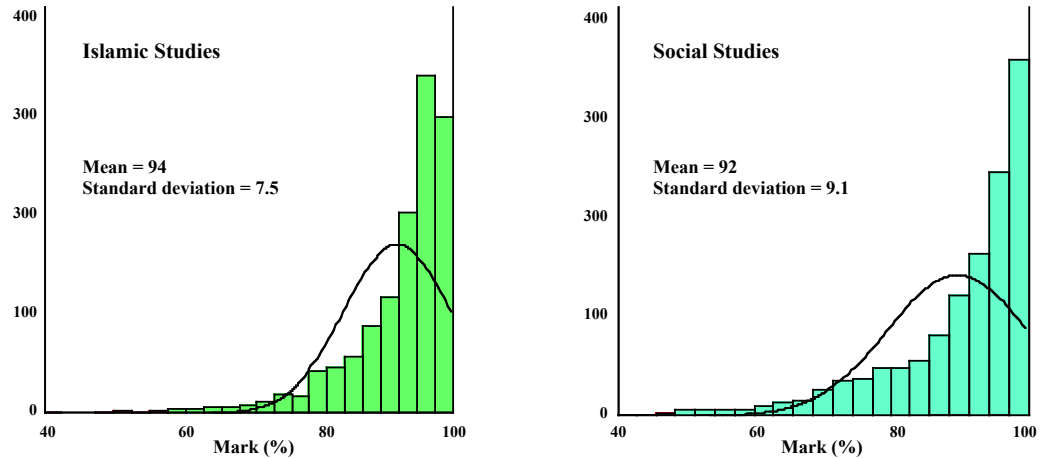
**Table 8.1 Factor Loading Analysis (Science Schools)**

Firstly, accounting for 75% of the variance is high: three quarters of the variance is ‘*explained*’ by the one factor. Secondly, the English marks do not load quite as highly on the one factor, suggesting that the English examination may not be focussing quite so tightly on recall.

Thirdly, the actual marks are far too high, making discrimination of ability, especially of the more able, very difficult. The average mean for the 8 subjects is nearly 84% when a mean nearer 60% might be much more appropriate. Fourthly, in Bahrain, the marks used by the examinations system are raw marks and there is no attempt to standardise in any way. This reveals that examinations are set at a level close to trivial and a consideration of the actual papers confirms this.

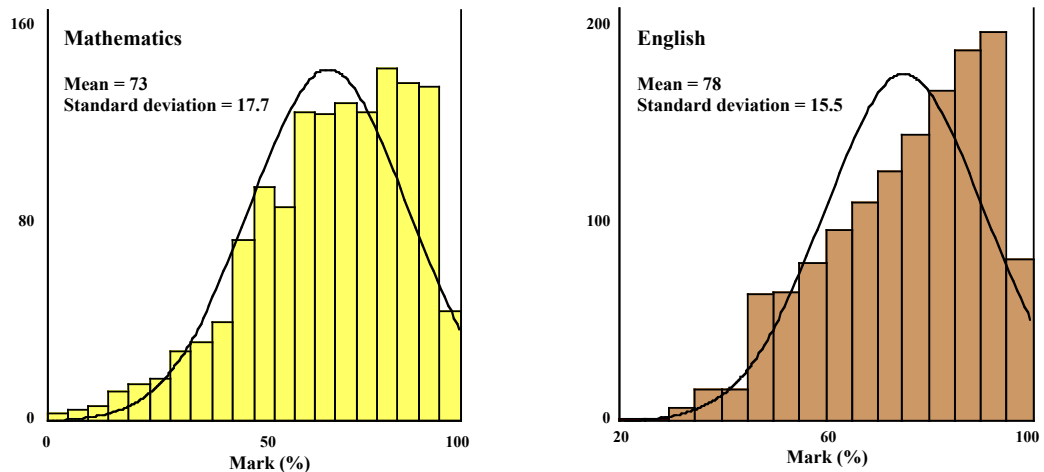


This is illustrated in figures 8.7 and 8.8 which show the worst two (in terms of assessing at too trivial a level) subjects (Islamic Studies and Social Studies) and the best two subjects (English and Mathematics).



**Figure 8.7 Marks Distributions Islamic Studies and Social Studies (Science Schools)**

English and Mathematics show more appropriate marks ranges although still far from satisfactory.



**Figure 8.8 Marks Distributions Mathematics and English (Science Schools)**

### Correlations

Inter-subject Pearson correlations confirm that English is slightly different (table 8.2)

Subject	Mathematics	Biology	Chemistry	Physics	Social Subjects	Islamic Studies	English
Arabic	0.71	0.78	0.79	0.74	0.68	0.68	0.65
Mathematics		0.75	0.83	0.87	0.71	0.68	0.60
Biology			0.83	0.78	0.73	0.75	0.57
Chemistry				0.85	0.72	0.69	0.62
Physics					0.77	0.73	0.63
Social Subjects						0.78	0.58
Islamic Studies							0.49

**Table 8.2 Pearson correlations (Science Schools)**

### Gender Comparison

The performance of girls and boys is compared as shown in table 8.3.

Subject	Girls (N = 1050)		Boys (N = 283)		Comparison	
	Mean	Standard Deviation	Mean	Standard Deviation	t-test	p
Arabic	86.5	9.1	81.1	10.5	7.7	< 0.001
Mathematics	73.1	17.5	70.0	17.8	2.7	< 0.01
Biology	90.1	9.8	86.9	11.7	4	< 0.001
Chemistry	80.6	14.1	75.0	15.0	5.6	< 0.001
Physics	80.1	12.7	80.1	13.3	0.8	n.s.
Social Subjects	92.3	9.2	92.2	8.6	0.6	n.s.
Islamic Studies	93.8	7.3	92.6	8.0	2.3	< 0.05
English	77.4	15.9	78.9	13.8	1.5	n.s.

**Table 8.3 Gender Comparison (Science Schools)**

Girls always outperform boys in most subject areas (table 8.3).

## 8.6 Literary Schools

The Scree plot gives two factors, accounting for 84% (74+10) of the variance (table 8.4).

Literary Schools (N = 803)				
Subject	Factor Loadings		Mean	Standard Deviation
	Factor 1	Factor 2		
Arabic	80	38	50	9.6
English	31	95	50	9.3
Social Subjects	86	31	71	13.4
Contemporary	88	23	75	13.7
Environmental	82	31	74	12.3
Islamic Studies	87	28	51	9.3

**Table 8.4 Factor Loading Analysis (Literary Schools)**

The general pattern is very similar to that obtained from the science schools. All the subjects (except English) are simply testing recall and the examinations are being set at an undemanding level. Again, Islamic Studies and Social Studies are giving data that suggest that the examinations are far too easy although the standard deviation for Social Studies is quite reasonable.

### *Correlations*

Inter-subject Pearson correlations confirm that English is slightly different (table 8.5).

Subject	Arabic	English	Social Subjects	Contemporary	Environmental
English	0.57		0.55	0.50	0.54
Social Subjects	0.80	0.55		0.79	0.74
Contemporary	0.75	0.50	0.79		0.75
Environmental	0.71	0.54	0.74	0.75	
Islamic Studies	0.73	0.57	0.79	0.78	0.76

**Table 8.5 Pearson correlations (Literary Schools)**

The correlation values for English are about 0.2 less than those for other inter-relationships.

### Gender Comparisons

Subject	Girls (N = 473)		Boys (N = 323)		Comparison	
	Mean	Standard Deviation	Mean	Standard Deviation	t-test	p
Arabic	52.0	9.7	47.0	8.7	7.3	< 0.001
English	49.3	10.0	50.2	8.0	1.3	ns.
Social Subjects	72.0	14.2	68.9	11.9	3.2	< 0.01
Contemporary	74.9	14.1	75.2	13.0	9.3	ns.
Environmental	73.8	13.3	75.3	10.8	1.7	ns.
Islamic Studies	50.7	10.0	51.8	8.1	1.6	ns.

**Table 8.6 Gender Comparison (Literary Schools)**

Girls outperform boys in only two subjects (table 8.6).

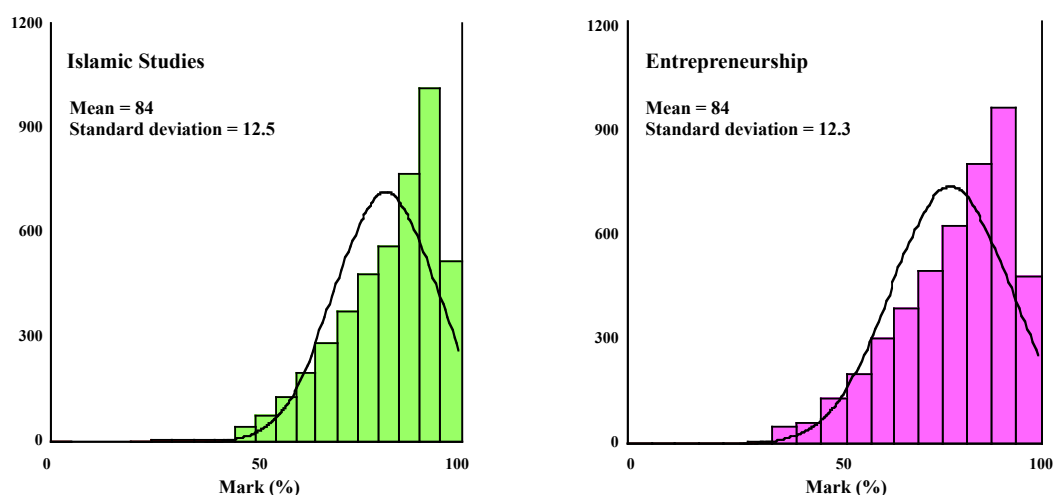
### 8.7 Commerce Schools

The Scree plot gives only one factor, accounting for 76% of the variance (table 8.7).

Commerce Schools (N = 4886)			
Subject	Factor Loadings	Mean	Standard Deviation
Arabic	0.84	73.9	11.9
English	0.74	74.1	14.2
Mathematics	0.89	63.0	19.9
Environmental	0.89	78.7	12.7
Economics	0.91	76.3	14.7
Banking	0.90	81.6	12.8
Accounting	0.87	78.0	14.7
Entrepreneurship	0.84	84.1	12.3
Islamic Education	0.86	84.4	12.5
History	0.87	82.2	12.7

**Table 8.7 Factor Loading Analysis (Commerce Schools)**

The sample here is very large but the pattern of outcomes is very similar to that obtained for the other two groups of schools. Although the means for the examination scores are too high, the spread of marks is more satisfactory in all subject areas. This can be illustrated by looking at the marks distributions for the two subjects whose means are far too high. Such means make discrimination of ability, especially of the more able, almost impossible.



**Figure 8.9 Marks Distributions Islamic Studies and Entrepreneurship**

### *Correlations*

Inter-subject Pearson correlations are again far too high (table 8.8).

Subject	Arabic	English	Mathemat-ics	Environ-mental	Econom-ics	Banking	Account-ing	Entrepren-urship	Islamic Education
English	0.63								
Mathematics	0.73	0.62							
Environmental	0.75	0.62	0.76						
Economics	0.75	0.61	0.79	0.80					
Banking	0.74	0.64	0.79	0.78	0.82				
Accounting	0.70	0.61	0.82	0.73	0.76	0.77			
Entrepreneurship	0.60	0.53	0.70	0.72	0.74	0.71	0.70		
Islamic Education	0.69	0.55	0.71	0.75	0.76	0.73	0.70	0.75	
History	0.67	0.60	0.72	0.75	0.75	0.73	0.70	0.78	0.78

**Table 8.8 Pearson correlations (Commerce Schools)**

In this case, The correlation values for English are slightly lower, suggesting that English is also measuring something beyond recall.

### Gender Comparisons

	Girls (N = 3049)		Boys (N = 1837)		Comparison	
Subject	Mean	Standard Deviation	Mean	Standard Deviation	t-test	p
Arabic	76.2	11.3	69.8	11.9	18.3	< 0.001
English	74.0	15.0	74.1	12.7	0.1	ns.
Mathematics	65.1	20.3	59.3	18.5	10.0	< 0.001
Environmental	79.3	13.0	77.6	12.0	4.5	< 0.001
Economics	76.7	15.4	75.5	15.5	2.8	< 0.01
Banking	81.8	15.0	81.2	12.4	1.4	ns.
Accounting	80.2	14.0	74.3	15.2	12.8	< 0.001
Entrepreneurship	83.3	12.4	85.6	12.0	6.1	< 0.001
Islamic Education	84.7	12.7	83.7	12.2	2.6	< 0.01
History	81.8	13.4	83.0	11.5	3.4	< 0.001

**Table 8.9 Gender Comparison (Commerce Schools)**

Girls outperform boys in most subject areas (table 8.9).

### 8.8 Conclusions

From the results above, the following key points can be made about the national examination system employed in Bahrain:

- 🏆 Marks are being used and are seen to be ‘absolute’ (in that a mark of, say 80%, is comparable from year to year or that it indicates a high level of success);
- 🏆 Most examinations are far too easy;
- 🏆 Most examinations do not differentiate well between student ability: the very able are not allowed to ‘shine’: thus discrimination is low.
- 🏆 The correlations between subjects are far too high;
- 🏆 The factor analyses show that all subjects (with the possible exception of English) are measuring the same skill in Bahrain. Looking at examination papers suggests that this has to be recall.

The students identified their disquiet on the examinations they have had to face. An analysis of the data for one year for three different kinds of schools reveals some common problems. These need to be addressed urgently if quality of performance is to be developed. Indeed, national examinations almost always control what teachers do in

their own school assessment. It could be argued that putting the national examination system right would have quite far-reaching effects on every aspect of education.

This offers an agenda for improved quality in Bahrain:

- (a) Examiners need to be taught that marks have no absolute value;
- (b) Examination setters need to be trained to set standards which will give acceptable means and standard deviations;
- (c) All marks in all subjects need to be standardised on to some suitable scale;
- (d) The emphasis on recall needs to be replaced by an emphasis on other more important skills, understanding being important;
- (e) Examiners in English need consulted to see why they are doing things better.

## Chapter 9

### Group Work

#### 9.1 Background

In chapter seven, the first survey asked students about their preferred way of working and there was a very strong preference for working collaboratively:

I prefer working on my own.    12    6    10    10    14    47    I prefer working with others.

In life, people tend to work in collaboration with others. In schools, students are forced to learn much of their time on their own while collaboration is often labelled as '*cheating*'.

This was supported by an interesting reaction to what they saw as the most helpful ways of learning. Students were asked to tick two reasons (from a list of 8) that they thought are the most helpful for their learning. Their top two choices were:

67    Working in a group.

60    Questions and discussion with the teacher.

The students in the secondary schools in the Bahrain are giving a clear message that they want more opportunities to work collaboratively, probably with less emphasis on the traditional lecture-type lessons which are the norm.

In order to explore how the students would react to learning by means of group work, it was necessary to allow them to experience some group work activities. Given time constraints, this could not be carried out in many subject areas. In addition, group work exercises would have to be developed or a suitable source identified.

Chemistry was, therefore, chosen as a useful subject area in the curriculum but this meant that any study of the use of group work exercises could only be carried out in science schools. The key reasons behind the decision to focus on chemistry are:



- ☑ Good sources of numerous problem-based chemistry group work units were found;
- ☑ Chemistry had been identified as a subject of lower popularity;
- ☑ Chemistry is the original discipline of the researcher, allowing appropriate editing to fit the Bahrain situation to be carried out easily.

Three sources of numerous problem-based group work units were found in the work of Yang (2000), Hussein, 2006) and the monograph edited by Wood (1993). Units from these sources were considered and number were selected, with minor editing to fit the Bahrain syllabus. They were then translated into Arabic and the translation checked.

It has to be recognised that the units were designed for Western curricula where the use of group work is quite common. The used styles totally unfamiliar to students in Bahrain where teaching and learning tends to lecture-based and highly didactic. The students were not prepared in any way for this new experience and their teachers were not trained either. The approach would be entirely foreign to the teachers. The units were self-contained and the teachers were instructed to allow them to operate and not to intervene unless the students became totally confused.

## 9.2 Groupwork Units Chosen

In the current experiment, the researcher studied the Bahraini curriculum of Chemistry for the three secondary school levels (levels 1 to 3, ages 15-18) and selected units for learners. From these units, questions have been generated for discussion. In fact, the learners were asked to work collaboratively on the given issues and provide relevant solutions. The time devoted for each of these units has been set accordingly (based on original guidance from the authors in their original documentation) prior to the implementation of the experiment. All the units were free in the public domain.

The units selected are listed in table 9.1.

	Possible Units	Source	Time	Level
1	Which is the best fuel	Yang 2	35	2/3
2	The glowing splint problem	Yang 5	25	2/3
3	Moving gases	Yang 8	25	2/3
4	The formula for ozone	Yang 9	30	2/3
5	The phosphorus problem	Yang 10	25	2/3
6	Salt, salts and pH	Yang 12	25	2/3
7	Solubility	Yang 13	35	2/3
8	Trees and cars	Yang 15	35	1/2/3
9	Bonding	Yang 16	20	1/2/3
10	Marvels of Growing Hair	Wood	30	3
11	Periodic Table	Hussein part 1	30	1/2/3
12	Periodic Table	Hussein part 2	15	1/2/3
11+12	Periodic Table	Hussein parts 1 and 2	45	1/2/3
13	Periodic Table	Hussein part 3	25	2/3

**Sources:**  
 Yang, M-J. (2000) Problem Solving in Chemistry at Secondary School, PhD Thesis, University of Glasgow, <http://theses.gla.ac.uk/2161/>  
 Hussein, F.A.A. (2006), Exploring attitudes and difficulties in school chemistry in the Emirates, PhD Thesis, University of Glasgow.  
 Wood, C.A. (1993) Creative Problem Solving in Chemistry, C.A. Wood, Royal Society of Chemistry, London,. ISBN 1-870343-28-X.

Table 9.1 Units Considered

The units are shown in full in appendix (3). However, table 9.2 gives a brief summary of the content.

	Possible Units	Description
1	Which is the best fuel	Given some key data, students have to determine which fuel gives most energy per kilogramme.
2	The glowing splint problem	Given some key data, the students have to determine why the gases coming out of the test are found to rekindle a glowing splint.
3	Moving gases	Given some key data, students have to determine why gases have different moving speeds. (Here, the accurate answer is not so important as seeing how a possible answer may be obtained).
4	The formula for ozone	Given some key data, students have to determine the formula for Ozone.
5	The phosphorus problem	Given some key data, students have to determine a way to obtain pure phosphorus solid safely from an industrial furnace.
6	Salt, salts and pH	Given some key data, students have to draw conclusions from the salts and pH table.
7	Solubility	Given some key data, students have to determine possible conclusions and approaches from table of solubility of some salts.
8	Trees and cars	Given some key data, students have to determine a way to find out if one tree in one year can use up the carbon dioxide produced by an average small car in one year.
9	Bonding	Given some key data, students have to determine a way to find out what type of bonding exists in aluminum chloride for which a possible formula might be: $AlCl_3$
10	Marvels of Growing Hair	Given some key data, students have to determine how many amino acid units are attached to a strand per second as your hair grows.
11	Periodic Table	Given some key data, students have to discuss aspects of the sources and 'common-ness' of elements using background knowledge and the internet.
12	Periodic Table	Given some key data, students have to discuss patterns in the discovery dates of the elements, interpreting these in terms of reactivity as well as looking at pattern in sizes of atoms.
11+12	Periodic Table	Combines units 11 and 12.
13	Periodic Table	Given some key data, students have to interpret patterns in ionisation energies and other periodic properties.

Table 9.2 Description of Units

### 9.3 Methodology

The experiment was conducted in the following way. The aim was to,

- (1) Gain some information about student reaction to this completely new approach;
- (2) Gain some evidence that this approach was effective in learning chemistry.

The experiment involved group work units and, because the approach was completely new, it was decided that students should undertake 2 or 3 units, time demands preventing any more. Permission was sought from the Ministry of Education to gain access to schools, the documents being shown in the appendix. In order to make the entire process manageable, six secondary schools (levels 1 to 3, ages 15-18: three girls schools, three boys schools) were selected randomly, giving a sample that is typical of the Bahrain secondary population in terms of catchment areas and urban-rural schools.

Contact was made with the schools. Teachers were offered some choice in the group work units to be undertaken. Test material was developed and distributed to the schools, the test being applied after the students had completed all the units.

The samples are shown in table 9.3. A large number of students was involved.

Students	Schools	Level			Total
		1	2	3	
<i>Boys</i>	3	166	96	94	356
<i>Girls</i>	3	154	154	153	461
<b>Total</b>	<b>6</b>	<b>320</b>	<b>250</b>	<b>247</b>	<b>817</b>

**Table 9.3 Sample selection**

The size of the sample was determined by the requirements of the experimental structure planned (which is described later) as well as the possibility of making gender comparisons. A larger sample might have been slightly better but there were limits in gaining access to schools for the time needed.

The experiment took 2 lessons, with a total time of about 2 hours and students undertook the final assessment at the end of the second lesson. For the first visit to each school, the researcher directed the work with one class, with teachers observing. These teachers then repeated the procedures with other classes.

The units used had to reflect the curriculum in chemistry in the schools. A wide selection of units in existence at the time was considered. Units were chosen to reflect the curriculum in Bahrain while allowing teachers a small element of choice. The aim was to make the entire exercise as realistic as possible. In other words, if group work units was to be introduced into schools, teachers would select those that they considered most appropriate and would form groups in their own way. The researcher effectively was giving a demonstration of a possible way to arrange things and small groups of 3-4 were employed, with no attempt to form groups by ability or based on friendship. The important element was to evaluate the effectiveness of using such an approach under normal classroom conditions.

With level 1 students, they had studied very little chemistry before this course and two units (numbers 11 and 12) suited their state of limited experience. Other units required too much background knowledge. Therefore, the study followed an experimental-control group structure. The final assessment compared the performance of the experimental group (who had undertaken units 11 and 12) with the control group who had followed the traditional teaching (see the diagram structure on the following page).

With levels 2 and 3, their experience in chemistry allowed them to tackle a wider range of units and it was possible for every student to undertake three units. In this case, the final assessment focussed on two units for each year group. One group in each year group had undertaken one until the other had undertaken the other unit. This structure had the advantage of allowing all students to experience the new approach (an issue of equity) and also allowed for any imbalances between the two groups to be evened out.

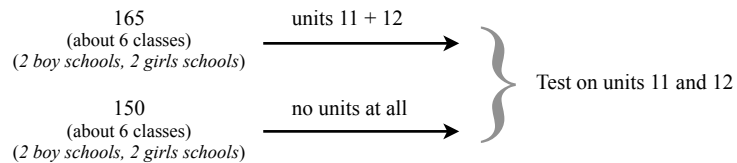
All the groups were random in the sense that they were the classes selected in each school by the teachers.

The procedure can be summarised:

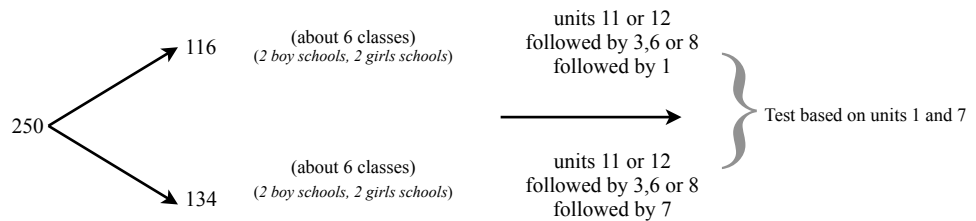
- 🏆 Level 1 students undertook two units: units 11 + 12. This was set up as a control-experimental structure, some students not undertaking any units while some completed both units. The test material was based on both units.
- 🏆 Level 2 or 3 students undertook three units, but the final assessment was only based on units 1 and 7. In level 2, half of the students undertook unit 1 as the final of three units while the other half undertook unit 7 as the final of three units. In level 3, units 2 and 9 were assessed.
- 🏆 It was suggested to the schools that groups mainly of three students were appropriate (with occasional groups of 4 where necessary). This followed the way the original units had been developed.
- 🏆 The students were allowed to use any resources they wished.

The experimental structure is shown below:

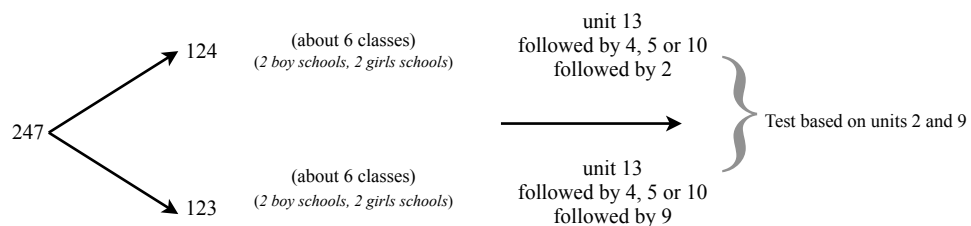
### Level 1



### Level 2



### Level 3



Thus, for level 1, the evaluation will compare the two groups as control and experimental. For levels 2 and 3, each group will act as *both* control and experimental.

### 9.3.1 Evaluation Methodology

The tests used to evaluate the impact of the three current experiments of the three secondary school levels in Bahrain were structured in the following manner.

- 🕒 Each evaluation will contain two questions which aimed to test against the skills (not content) developed by the unit concerned.
- 🕒 There will be a third question, which will adopt the semantic differential format, looking at the student reaction to group work.

Therefore, three tests were designed, one for each of the levels in the secondary Bahraini schools. A teacher's guide for each level was also issued to assist the participant teachers in the administration of these three tests. Although the test is based on the subject chemistry, the items aimed to measure the skills gained.

Each test was short, planned to last up to 20 minutes although few used the entire time. The purpose of the tests was to measure to what extent the learners learned from working in groups on the given units. The students were told that marks gained would not affect their school grades. The style of test was designed to be '*user-friendly*'.

It has to be recognised that not only were the group work units a completely new experience for all the students but the test approach was also totally novel. The students were only familiar with tests (usually fill in or very short answers) that simply measured recall.

The three tests along with the teachers' guides are shown in full in the following pages:

**Level 1 Test ( Year 1)**  
**An Interesting Problem**

*Here is an unusual problem to think about.  
You should try this on your own.  
What you do will not count for any school marks.  
All the best!*

Here is a copy of the periodic table, showing the elements in atomic number order.

<sup>1</sup> H																	<sup>2</sup> He
<sup>3</sup> Li	<sup>4</sup> Be											<sup>5</sup> B	<sup>6</sup> C	<sup>7</sup> N	<sup>8</sup> O	<sup>9</sup> F	<sup>10</sup> Ne
<sup>11</sup> Na	<sup>12</sup> Mg											<sup>13</sup> Al	<sup>14</sup> Si	<sup>15</sup> P	<sup>16</sup> S	<sup>17</sup> Cl	<sup>18</sup> Ar
<sup>19</sup> K	<sup>20</sup> Ca	<sup>21</sup> Sr	<sup>22</sup> Ti	<sup>23</sup> V	<sup>24</sup> Cr	<sup>25</sup> Mn	<sup>26</sup> Fe	<sup>27</sup> Co	<sup>28</sup> Ni	<sup>29</sup> Cu	<sup>30</sup> Zn	<sup>31</sup> Ga	<sup>32</sup> Ge	<sup>33</sup> As	<sup>34</sup> Se	<sup>35</sup> Br	<sup>36</sup> Kr
<sup>37</sup> Rb	<sup>38</sup> Sr	<sup>39</sup> Y	<sup>40</sup> Zr	<sup>41</sup> Nb	<sup>42</sup> Mo	<sup>43</sup> Te	<sup>44</sup> Ru	<sup>45</sup> Rh	<sup>46</sup> Pd	<sup>47</sup> Ag	<sup>48</sup> Cd	<sup>49</sup> In	<sup>50</sup> Sn	<sup>51</sup> Sb	<sup>52</sup> Te	<sup>53</sup> I	<sup>54</sup> Xe
<sup>55</sup> Cs	<sup>56</sup> Ba	<sup>57</sup> La	<sup>72</sup> Hf	<sup>73</sup> Ta	<sup>74</sup> W	<sup>75</sup> Re	<sup>76</sup> Os	<sup>77</sup> Ir	<sup>78</sup> Pt	<sup>79</sup> Au	<sup>80</sup> Hg	<sup>81</sup> Tl	<sup>82</sup> Pb	<sup>83</sup> Bi	<sup>84</sup> Po	<sup>85</sup> At	<sup>86</sup> Rn

A small set of common metals has been shaded in.

These metals can be placed in order of reactivity, where potassium is the most reactive.

K      Na      Li      Ba      Ca      Mg      Al

- (a) Using the periodic table, predict where Sr (Strontium) might be placed in this order of reactivity.

Write the symbol 'Sr' between two of the metals

K      Na      Li      Ba      Ca      Mg      Al

- (b) Looking at the whole periodic table, suggest which metal would be expected to be most reactive of all.

Write down its symbol: .....

- (c) Predict which is more reactive: Fluorine (F) or Iodine (I): .....

## Tell us what you think ....

What are your opinions about *learning in school*

Tick one box on each line

I feel I am coping well	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I feel I am not coping well
I am not enjoying school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I enjoy school
I prefer learning on my own	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I prefer learning as part of a group
Work at school is relevant to my needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Work at school is irrelevant to my needs
I enjoy discussions in class	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I do not enjoy discussion in class
I like work where there are clear-cut right answers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I like work which involves open-ended discussion
I understand the work better after discussing it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Discussion does not help me to understand better

**Teacher's Guide**

**Level 1 Test ( Year 1)**

*The students should undertake this test under examination conditions*

*Please remind the students that the marks will not count for any school examination*

Allow up to 20 minutes for the test.

**For your Interest**

This test seeks to explore if the students can use the periodic table to interpret and to predict.

The order of reactivity is based on going up the columns of the periodic table:

The complete reactivity order might be seen in terms of:

Column 1 - from bottom to top

Column 2 - from bottom to top

Column 3 - from bottom to top

- (a) On this basis, the reactivity of Strontium lies between Barium and Calcium
- (b) The most reactive metal will lie at the foot of column 1: Caesium (Cs)
- (c) Can they see that non-metals behave in opposite ways to metals. Thus, they might deduce that the order of reactivity lies from top to bottom, making fluorine the most reactive and iodine the least in the column (ignoring radioactive astatine).

**Answers**

- (a) Strontium (Sr)
- (b) Caesium (Cs)
- (c) Fluorine (F)

**[All this was given for information only as all tests were marked by the researcher]**



## Level 2 Test ( Year 2)

## An Interesting Problem

*Here is an unusual problem to think about.*

*You should try this on your own.*

*What you do will not count for any school marks.*

*All the best!*

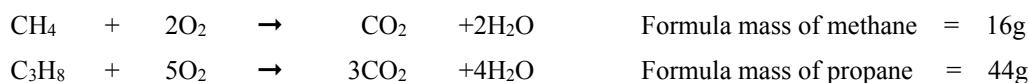
## Question 1

The main gas in natural gas is methane:  $\text{CH}_4$

The main gas in bottled gas is propane:  $\text{C}_3\text{H}_8$

Which will give more heat energy when burned completely?

Here are the equations:



Imagine you have 176 g of each gas which you burn.

Assume that the energy released is related to the number of molecules formed.

In other words, the more molecules formed, the greater the energy released.

You won't need to use a calculator - just carry out rough calculations.

## Question 2

Different compounds tend to dissolve in water to different extents.

Here is a table of solubility of some salts, expressed in grams per 100 grams of solution at room temperature.

Look at the bottom number in the first column in the table (the  $\text{OH}^-$  column). It tells us that if we have barium hydroxide  $[\text{Ba}(\text{OH})_2]$ , then we can expect 14g to dissolve in 100g of water at room temperature.

	$\text{OH}^-$	$\text{F}^-$	$\text{Cl}^-$	$\text{CO}_3^{2-}$	$\text{NO}_3^-$	$\text{SO}_4^{2-}$
$\text{Ca}^{2+}$	0.16	0.0016	75	0.002	129	0.21
$\text{Sr}^{2+}$						
$\text{Ba}^{2+}$	14	0.12	36	0.002	9	0.0002

The values for strontium are missing. Write in your rough estimate of what these numbers might be.

## Tell us what you think ....

What are your opinions about *learning in school*

Tick one box on each line

I feel I am coping well	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I feel I am not coping well
I am not enjoying school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I enjoy school
I prefer learning on my own	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I prefer learning as part of a group
Work at school is relevant to my needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Work at school is irrelevant to my needs
I enjoy discussions in class	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I do not enjoy discussion in class
I like work where there are clear-cut right answers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I like work which involves open-ended discussion
I understand the work better after discussing it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Discussion does not help me to understand better

## Teacher's Guide

## Level 2 Test ( Year 2)

*The students should undertake this test under examination conditions*

*Please remind the students that the marks will not count for any school examination*

Allow up to 20 minutes for the test.

**For your Interest**

This test seeks to explore if the students can interpret equations and quantities. The numbers chosen are such that no calculators are needed at all. Here is a possible logic to gaining an answer.

Given the formula mass of methane is 16g, they may be able to see that 176g involves 11 formula masses [ $176 = 11 \times 16$ ].

The equation gives 3 molecules for every molecule of methane burned.

Therefore, 33 molecules will come from 11 molecules of methane.

Given the formula mass of propane is 44g, they may be able to see that 176g involves 4 formula masses [ $176 = 4 \times 44$ ].

The equation gives 7 molecules for every molecule of methane burned.

Therefore, 28 molecules will come from 4 molecules of propane.

Thus, methane gives rise to more product molecules and might be expected to give more heat energy per gram burned. In fact, accurate calculations based on enthalpies of combustion show that this is true.

In the second question on solubility, the question seeks to explore if the students can see that the behaviour of Strontium will lie between that of calcium and barium

**Answer**

- (1) Methane
- (2) Values between those for calcium and barium

## Level 3 Test (Year 3)

## An Interesting Problem

*Here is an unusual problem to think about.*

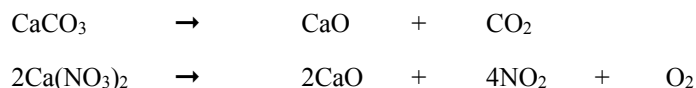
*You should try this on your own.*

*What you do will not count for any school marks.*

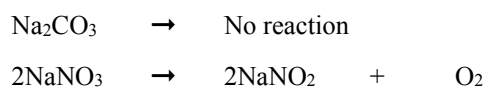
*All the best!*

## Question 1

When calcium carbonate and calcium nitrate are heated strongly, they give the following products:



When sodium carbonate and sodium nitrate are heated similarly, they give the following products:

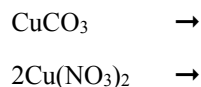


- (a) Suggest a reason why the sodium compounds behave differently

.....

- (b) Predict what would happen with copper carbonate and copper nitrate.

Write the equations for the reactions you would expect:



## Question 2

You are given a small bottle of white ammonium nitrate crystals. The formula for ammonium nitrate is:



*Experiment 1:* You find that the white crystals dissolve very rapidly in water and that the solution conducts electricity.

*Experiment 2:* You heat a few crystals and they melt rapidly and then there is a slight 'pop' and gases are formed.

Suggest any conclusions you can draw from these observations:

- (a) Experiment 1: .....

- (b) Experiment 2: .....

## Tell us what you think ....

What are your opinions about *learning in school*

Tick one box one each line

I feel I am coping well	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I feel I am not coping well
I am not enjoying school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I enjoy school
I prefer learning on my own	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I prefer learning as part of a group
Work at school is relevant to my needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Work at school is irrelevant to my needs
I enjoy discussions in class	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I do not enjoy discussion in class
I like work where there are clear-cut right answers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I like work which involves open-ended discussion
I understand the work better after discussing it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Discussion does not help me to understand better

## Teacher's Guide

## Level 3 Test ( Year 3)

*The students should undertake this test under examination conditions*

*Please remind the students that the marks will not count for any school examination*

Allow up to 20 minutes for the test.

**For your Interest**

In the first question, can the students see the different patterns of reactions are simply interpreted in terms of reactivity. Sodium, being a more reactive metal, '*holds on*' to the other elements more strongly.

Thus, copper, being less reactive than calcium, will show the same behaviour as calcium and not the same behaviour as sodium.

The second question seeks to explore if they can interpret experimental data.

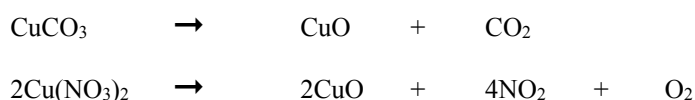
The solution conducting electricity indicates the presence of ions. Thus, they might consider that ammonium nitrate contains ions.

The low melting temperature and rapid decomposition (to a mixture of nitrogen, oxides of nitrogen and water) suggest covalent or polar covalent behaviour.

In fact, ammonium nitrate contains ions  $[\text{NH}_4^+ \quad \text{NO}_3^-]$  in each of which are polar covalent bonds [N-H and N-O bonds]. In addition, the two ions can oxidise and reduce each other, given a little heat energy. However, they are not expected to deduce the oxidation-reduction possibility!)

**Answers**

(1) Sodium, being a more reactive metal, '*holds on*' to the other elements more strongly.



(2) Experiment 1: suggests ionic character

Experiment 2: suggest (polar) covalent character

### 9.3.2 Methodology: Test Marking

The three tests were marked as follows:

Level 1	Level 2	Level 3
1 mark for each part	4 marks for methane. Award partial marks for evidence of correct thinking	2 marks for explanation based on sodium being more reactive than calcium
	2 marks for values between calcium and barium.	2 marks for copper equations identical to those for calcium
		2 marks for experiment 1 suggesting ions
		2 marks for experiment 2 suggesting bonding of covalent or polar covalent nature
		Bonus mark if anyone suggests the likely products
<b>Total: 3 marks</b>	<b>Total: 6 marks</b>	<b>Total: 8 marks</b>

**Table 9.4 Marking Schemes**

Data from the three tests of each level was first entered in separate spreadsheets and then it was transferred to SPSS. SPSS was used to calculate t-test values and to generate the frequencies for responses to the final question. Chi-square calculations were carried out using a program designed for the purpose.

The data obtained are now summarised and discussed.

## 9.4 Year 1 Group Comparisons

### Survey Comparisons

The two groups were given a survey to measure their perceptions on their learning experience at school. The first is the experimental group where learners have been working in groups on problem-solving task-based activities. The second is the control group where learners have been carrying on learning as usual.

The response patterns are shown in table 9.5.

%	N	I feel I am coping well			I feel I am not coping well			$\chi^2$	p
Experimental	155	51	8	6	9	3	23	15.8 (5)	< 0.01
Control	165	40	10	10	20	3	19		
		I am not enjoying school			I enjoy school				
Experimental	155	34	8	8	16	4	31	9.6 (5)	n.s.
Control	165	31	8	9	16	8	29		
		I prefer learning on my own			I prefer learning as part of a group				
Experimental	155	34	4	2	15	5	40	6.4 (4)	n.s.
Control	165	26	5	4	16	6	43		
		Work at school is relevant to my needs			Work at school is irrelevant to my needs				
Experimental	155	29	4	8	14	4	42	9.5 (4)	< 0.05
Control	165	24	9	8	15	8	35		
		I enjoy discussions in class			I do not enjoy discussion in class				
Experimental	155	45	5	5	13	7	24	19.6 (4)	< 0.001
Control	165	46	14	8	10	7	16		
		I like work where there are clear-cut right answers			I like work which involves open-ended discussion				
Experimental	155	32	5	4	17	4	37	6.5 (4)	n.s.
Control	165	26	5	9	22	4	34		
		I understand the work better after discussing it			Discussion does not help me to understand better				
Experimental	155	51	6	5	17	3	18	10.6 (4)	< 0.05
Control	165	47	13	9	14	3	15		

**Table 9.5 Students opinions about learning in school**

In many questions, the two groups show no statistically significant differences. However, the experimental group feel they are coping better although, having experienced a little group work, they do not enjoy discussions in class as much. They hold more extreme views about the relevance or irrelevance of work at school.

*Analyses using t-tests (independent groups)*

## Experimental-control comparisons

	Sample	N	Mean	Standard Deviation	t	p
<b>Question 1</b>	<i>Experimental</i>	155	34	47	0.2	n.s.
	<i>Control</i>	165	33	47		
<b>Question 2</b>	<i>Experimental</i>	155	8	28	-1.4	n.s.
	<i>Control</i>	165	13	34		
<b>Question 3</b>	<i>Experimental</i>	155	62	48	2.4	< 0.01
	<i>Control</i>	165	48	50		
<b>Total</b>	<i>Experimental</i>	155	34	66	1.1	n.s.
	<i>Control</i>	165	32	74		

**Table 9.6 Experimental-control comparisons**

According to the table above, the most striking result is that learners have significantly learnt from working in groups as shown in question 3 (a prediction question) However, there is no overall gain in their learning. This suggest that group work brings no overall advantage or disadvantage.

*Gender Comparisons*

Firstly, boys from both groups are compared to girls from both groups.

N (boys) = 166 N (girls) = 154	t	p
<b>Question 1</b>	0.16	n.s.
<b>Question 2</b>	-1.4	n.s.
<b>Question 3</b>	2.4	< 0.01
<b>Total</b>	1.1	n.s.

**Table 9.7 Experimental-control comparisons**

Another interesting finding is that the girls performed better than the boys in question 3 (a prediction question).

The boys and girls in each group (experimental and control) are now compared. The numbers involved are shown in table 9.8.

		N
<i>Experimental</i>	<i>boys</i>	79
	<i>girls</i>	76
<i>Control</i>	<i>boys</i>	87
	<i>girls</i>	78

**Table 9.8 Number of participants (Level 1)**

The performance of the experimental and control groups are now compared, by gender.

	Boys		Girls	
	t	p	t	p
<i>Question 1</i>	2.3	< 0.05	-2.0	< 0.05
<i>Question 2</i>	-2.0	< 0.05	0.1	n.s.
<i>Question 3</i>	3.5	< 0.001	-0.12	n.s.
<i>Total</i>	2.8	< 0.01	-1.6	n.s.

**Table 9.9 Gender (experimental and control groups)**

Overall, boys in the experimental group have performed better than boys in the control group. However, the experimental boys have outperformed the control boys in questions 1 and 3, while the control boys have outperformed the experimental boys in question 2.

With the girls, the experimental group and control groups have performed similarly although control girls have outperformed the experimental girls in question 1.

These findings possibly reflect different teaching emphases in the schools (gender separated).

### ***Conclusions***

Overall, group work has only small advantages in terms of learning but it may have many advantages of a more general nature (group work skills, communication skills etc).



## 9.5 Year 2 Group Comparisons

### *Group 1 - group 2 comparisons*

Group 1 completed unit 1 and group 2 completed unit 7. Question 1 tested the skills that might be expected to have been developed by completing unit 1 while question 2 tested the skills that might be expected to have been developed by completing unit 7.

	Sample	N	Mean (%)	Standard Deviation	t	p
<i>Question 1</i>	<i>Group 1</i>	116	19.4	39.4	1.8	n.s.
	<i>Group 2</i>	134	11.2	30.7		
<i>Question 2</i>	<i>Group 1</i>	116	70.7	41.7	1.9	n.s.
	<i>Group 2</i>	134	60.1	46.6		

**Table 9.10 Group 1 - group 2 comparisons**

Completing either unit 1 or 7 has made little difference to the skills gained.

### *Gender Comparisons*

One of the interesting observations is that girls outnumber boys quite markedly. There is trend in Bahrain that girls are more interested in studying scientific subjects than boys. Indeed, boys in Bahrain tend to choose to follow business or technical studies.

N (boys) = 96 N (girls) = 154	t	p
<i>Question 1</i>	-1.9	< 0.05
<i>Question 2</i>	2.5	< 0.05
<i>Total</i>	-0.7	n.s.

**Table 9.11 Gender, overall**

Girls outperformed the boys in question 1 (unit 1) while boys outperformed the girls in question 2 (testing unit 7).

The boys and girls in each group (experimental and control) are now compared. The numbers involved are shown in table 9.12.

		N
<b>Group 1</b>	<i>boys</i>	42
	<i>girls</i>	74
<b>Group 2</b>	<i>boys</i>	54
	<i>girls</i>	80

**Table 9.12 Number of participants (Level 2)**

The performance of the experimental and control groups are now compared, by gender.

	<b>Boys</b>		<b>Girls</b>	
	<b>t</b>	<b>p</b>	<b>t</b>	<b>p</b>
<b>Question 1</b>	-2.8	< 0.01	0.0	n.s.
<b>Question 2</b>	-0.8	n.s.	-1.7	n.s.
<b>Total</b>	-2.7	< 0.01	-1.3	n.s.

**Table 9.13 Gender (groups)**

In question 1 (which tested unit 1), the experimental boys performed more poorly than the control boys. In question 2 for boys and both questions for girls, the use of group work has had not significant impact on performance on the skills which might be expected to be developed.

### ***Conclusion***

There seems to be little advantage in terms of test performance from the use of group work.

## 9.6 Year 3 group comparisons

### Group 1- group 2 comparisons

	Sample	N	Mean	Standard Deviation	t	p
<i>Question 1</i>	<i>Group 1</i>	124	53.0	32.6	2.9	< 0.01
	<i>Group 2</i>	123	40.7	34.5		
<i>Question 2</i>	<i>Group 1</i>	124	14.3	18.1	-3.3	< 0.001
	<i>Group 2</i>	123	23.4	24.3		

**Table 9.14 Group 1 - group 2 comparisons**

Group 1 performed better in question 1 (based on unit 2) and group 2 performed better in question 2 (based on unit 9). This suggests that both groups benefitted from the group work exercises.

N (boys) = 94 N (girls) = 153	t	p
<i>Question 1</i>	-0.5	n.s.
<i>Question 2</i>	2.4	< 0.05
<i>Total</i>	0.5	n.s.

**Table 9.15 Gender, overall**

		N
<i>Group 1</i>	<i>boys</i>	49
	<i>girls</i>	75
<i>Group 2</i>	<i>boys</i>	45
	<i>girls</i>	78

**Table 9.16 Number of participants ( Level 3)**

It is worth to highlight here that in the third experiment, boys are fewer in number than girls because, as mentioned earlier, girls take scientific subjects more than boys.

	Boys		Girls	
	t	p	t	p
<i>Question 1</i>	-5.1	< 0.001	0.2	n.s.
<i>Question 2</i>	-3.8	< 0.001	6.6	< 0.001
<i>Total</i>	-5.3	< 0.001	3.9	< 0.001

**Table 9.17 Gender (Boys and Girls groups)**

This table shows that the boys have benefitted from the third experiment in both question 1 and 2. Whereas the girls's results tend to imply that working in groups was only significant in the 2nd question.

### ***Conclusions***

Unlike the second experiment, the overall findings from the third experiment show that the Bahraini secondary school learners have benefitted from working in groups to solve problems through discussion.

## **9.7 Overall Conclusions**

Three experiments on working in groups took place in the three levels of Bahraini secondary schools. Overall, there were some advantages in terms of test performance from learning in groups but the effect did not show in all question in all year groups. The very short experience in a totally novel experience might be expected to give limited learning effects.

## 9.8 Student Reactions

All data as experimental groups - minimum value = 10

%	N	(a)	I feel I am coping well			I feel I am not coping well			$\chi^2$ (df)	p
Year 1	155		51	8	6	9	3	23	43.6(8)	< 0.001
Year 2	250		38	7	8	18	4	25		
Year 3	247		30	19	15	18	3	16		
		Growth in neutral positions with age ==>> less polarisation with age								
		(b)	I am not enjoying school			I enjoy school				
Year 1	155		34	8	8	16	4	31	15.8(8)	< 0.05
Year 2	250		32	7	7	15	8	31		
Year 3	247		19	10	9	15	13	35		
		Small but steady growth in enjoyment								
		(c)	I prefer learning on my own			I prefer learning as part of a group				
Year 1	155		34	4	2	15	5	40	15.9(6)	< 0.05
Year 2	250		24	5	7	15	7	41		
Year 3	247		28	7	9	21	7	30		
		Polarisation declines very slightly with age								
		(d)	Work at school is relevant to my needs			Work at school is irrelevant to my needs				
Year 1	155		29	4	8	14	4	42	24.2(8)	< 0.01
Year 2	250		22	5	8	18	10	38		
Year 3	247		14	8	13	24	13	29		
		Small move from relevance to uncertainty								
		(e)	I enjoy discussions in class			I do not enjoy discussion in class				
Year 1	155		45	5	5	13	7	25	18.5(6)	< 0.01
Year 2	250		41	9	12	14	3	20		
Year 3	247		34	16	10	17	7	16		
		Slight growth from not enjoyment to neutral								
		(f)	I like work where there are clear-cut right answers			I like work which involves open-ended discussion				
Year 1	155		32	5	4	17	4	37	5.7(6)	n.s.
Year 2	250		24	8	4	22	5	37		
Year 3	247		26	10	7	19	8	30		
		Nothing								
		(g)	I understand the work better after discussing it			Discussion does not help me to understand better				
Year 1	155		51	6	5	17	3	17	25.8(6)	< 0.001
Year 2	250		42	7	10	17	4	21		
Year 3	247		32	15	13	22	4	14		
		Polarisation declines with age								

**Table 9.18 Student Reactions**

Table 9.18 reveals a remarkable extent of polarization but the degree of polarization tends to fall with age (simple maturation). Enjoyment grows with age but, related to discussion, tends to decline.

## Chapter 10

### Summary And Conclusions

#### 10.1 Quality Assurance in Bahrain

The education system in Bahrain has developed very rapidly and the aim of the country is to have an education provision that matches world standards. This thesis focusses on the provision of education in the secondary stages (ages ~16-18). For several years, a quality assurance system has been operating in the Kingdom. However, there are strong signs of unrest in schools over the way the system is working, with a tendency of teachers to be inspected and then criticized, and few signs of substantive changes.

This study has aimed to gain an overall view of what is happening in secondary education in Bahrain and to identify areas which need further attention. The approach has been very much to focus on the learner, the underlying view being that education is there to bring benefit to learners. Arrangements and systems need to be designed with the learner at the centre.

In fact, the Quality Assurance system in Bahrain does not tend to focus on the learner and, therefore, it does not seem to have clear initiatives and guidelines in improving learners' academic achievements and learning experiences. This thesis investigates these issues in three stages.

In the first stage, data was collected from three groups. The most important group are the learners and the study explored the perceptions of school students nearing the end of their school career when asked to look back at their experiences. The second group are the practicing teachers. They have no control over the curriculum or the national assessment system and no control over resources made available. However, they have the task of offering the best learning experiences within these imposed limitations.

While the role of teachers is critical, the key decisions lie outside the schools. The third group considered those involved in the management of the educational provision as well as some headteachers.

The purpose of this data collection is to identify areas where there are issues to be addressed. With regard to learners (aged 18), a survey was used to throw light on the strengths and weaknesses of the actual educational provision from their perspective as well as ways by which the current system might be enhanced. For the teachers, a survey was also used to gain insights on what is happening at the secondary school level. With much smaller numbers of educational managers, interviews were employed to gain an insight into how they saw the education system and, in particular, how they viewed the quality assurance procedures.

Overall, the aim was to use this initial exploratory phase to pinpoint strengths and weaknesses in the educational provision and to direct the later stages of the study. The insights from the students turned out to offer a very clear and perceptive picture. Thus, the over-dependence on memorization stands out as a major weakness and this led to further exploration of the assessment systems used in the country.

The tendency in Bahrain is for lessons to be teacher-centred, with the teacher almost lecturing and the learners taking notes and using written materials and textbooks. The reaction of the students reflected a desire for a greater variety of approaches and there was an identified lack of opportunities for students to work collaboratively.

This led this study to explore how group work activities might be incorporated into the curriculum, using one major school discipline: chemistry. This discipline was chosen for two reasons: it is the researcher's original discipline and there are numerous group work units readily available and these were readily adapted for Bahrain.

In order to gain clear pictures of the situation and to explore the behavior of subgroups in the population, large samples were selected for each stage of the investigations (table 10.1). This allowed for the sample to reflect the entire population and make comparisons on the basis of gender or age, as appropriate.

Stage		Sub group	Sample
1	Student survey	Secondary Students Year 3	793
	Teacher survey	Secondary Teachers	793
	Interviews of educational managers	MoE, QAATE & some of head teachers	23
2	Study of data from final national examinations	Science Schools	1333
		Literary Schools	803
		Commerce Schools	4886
3	Use of group-work units in schools	Year 1 (age 15-16)	320
		Year 2 (age 16-17)	250
		Year 3 (age 17-18)	247

**Table 10.1 Summary of Samples in Study**

## 10.2 The key findings

The findings of this thesis can be divided in terms of the stages stated above. Indeed, we will first sum up the results found in the surveys of learners and teachers. We will, then, go over the concluding points of interviews conducted with senior staff in education including leaders in the Ministry of Education, Leaders in the Quality Assurance Authority, Head Teachers, and specialists in MOE and QAA. Thereafter, we will encapsulate the results obtained from our investigation of learners' assessments. Last, but not least, we will give the gist of the experiences of the learners working in groups when implemented in Bahraini secondary schools.



### 10.2.1 Stage 1 Findings

The relevant research question was:

- (1) How is quality perceived by various stakeholders involved in secondary education in Bahrain?

Surveying the perceptions of learners as they looked back over their experiences in secondary education in schools in Bahrain, several clear messages were apparent and are now listed, addressing research question 1(a):

- (1a) How is quality perceived by secondary school students when they look back over their educational experiences in secondary education in Bahrain?

Learners:

- ☒ Expressed the wish to learn through understanding rather than memorization.
- ☒ Emphasized the need to be taught through a wider range of teaching approaches.
- ☒ Advanced that they would like to work collaboratively in class.
- ☒ Indicated the need to have scope to think creatively.
- ☒ Mentioned that they wanted greater emphasis on visual learning.
- ☒ Claimed that they spend too much time in the sciences.
- ☒ Expressed the wish that the teaching of the sciences was more understandable.
- ☒ In the sciences, they wanted less science and better use of laboratories.
- ☒ Questioned the relevance of the curriculum.
- ☒ Said that the curriculum is overloaded as knowledge expands, curricula expand too.
- ☒ Wanted the assessment to be overhauled as national examination are rewarding recall and distorting teaching and learning.
- ☒ Wished to learn how to learn.
- ☒ Felt the need to improve student-learner relationships.
- ☒ Pinpointed that teachers need to be evaluated periodically, this suggesting that the present QA system is ineffective.

With the teachers' survey, the key deductions revealed six main points, addressing research question 1(b):

- (1b) How is quality perceived by secondary school teachers working in secondary education in Bahrain?

These are now listed.

Teachers:

- ☒ Were desperate for training and development.
- ☒ Questioned the current quality assurance procedures although they supported to idea of quality assurance.
- ☒ Saw the predominant aim of quality assurance in terms of generating improvement.
- ☒ Wanted to be trusted by the educational authorities.
- ☒ Wanted to be affirmed and supported rather than judged.
- ☒ Expressed the wish to improve the quality of education.

The third group was that of the educational managers. The findings here address research question 1(c).

- (1c) How is quality perceived by educational administrators who carry responsibilities in relation to secondary education in Bahrain?

The views expressed by those in the broad category of educational managers were very different from those expressed by the teachers and the students, where there was some measure of consistency. Thus, educational leaders have the tendency to describe the educational situation in Bahrain from a very different perspective. Overall they appear to wish for a better quality education but there was little evidence of any clear guidelines or shared agenda. Therefore, there is a need to establish a common language between senior staff in education and the teachers who are supposed to be the engine that ensures a continuous betterment of education. This will only be possible if the relevant agents from both sides are trained for the same purpose in the same way.

The findings here also address research question 2:

- (2) What specific aspects of the secondary education provision require adjustment or improvement to enhance quality in secondary education in Bahrain?

This is now discussed further in stages 2 and 3.

### 10.2.2 Stage 2 Findings

In fact, stage 2 and stage 3 addressed research question 2:

- (2) What specific aspects of the secondary education provision require adjustment or improvement to enhance quality in secondary education in Bahrain?

The school students are the key group in thinking of quality and their perceptions determined the agenda for stages 2 and 3. Time only permitted two aspects to be selected for further exploration, the first being assessment.

In this stage, the examination marks for a sample of 7022 students in their final year was gained. In Bahrain, there is a belief that marks mean something: thus, irrespective of the examination, marks over 90% indicate ‘*outstanding*’, while a 50% is a ‘*pass*’. There is no understanding that national examinations simply place students in some kind of rough order of merit and there are no absolute standards that can be deduced on the basis of the marks themselves.

The analysis of the national examination system used in Bahrain revealed that marks that are used in national examinations are considered as ‘*absolute*’ and the examinations were far too easy. Inevitably, this will mean that discriminations between learners in terms of abilities may be low, with, for example, very able learners are not given the opportunity to ‘*shine*’. In addition to this, the results indicate that the correlation between subjects are very high, and that the factor analyses indicate that all subjects (except, perhaps, English) tend to measure the same skill. Looking at the actual examination papers shows clearly this is ‘*memorization*’.

From these findings, there is an urgent need for examination setters at the MoE to change the nature and purpose of the national examinations so that school teaching is geared to develop other skills in learners. Most fundamental of all is understanding but

there is an important place for skills like critical thinking, creative thinking, scientific thinking, problem solving.

It is also timely for QAATE to improve its way in evaluating the teachers' school performance. Currently they tend to focus more on accountability rather than on how to continuously improve teachers' school delivery. In addition, their role should be in terms of providing teachers with alternatives and constructive feedback just after their school visits. Informal discussions with teachers reveal that the reports that they are currently writing for teachers are seen as unhelpful by the teachers and tend to hinder rather than benefit the teacher. This is because they criticise (sometimes unfairly or wrongly) but do not offer ways forward that will assist.

### **10.2.3 Stage 3 Findings**

In stage 1, the students had asked for more freedom to work in groups. The questions was whether this would aid their learning and how they would react to this. To explore this, in stage 3, a set of problem-based group work units was selected and adapted slightly, before translation into Arabic. All three year groups were involved but time limitations in gaining access to schools meant that students were only able to complete 2 or 3 of the units.

The evidence about the effectiveness of this approach in developing understanding of chemistry was ambivalent. There were some benefits but not too marked. However, the perceptions of the learners were positive in many ways although the actual experience was so totally new to them that their enthusiasm was not universal. However, in some areas working as a group did enhance understanding skills.

Overall in this study, no evidence was found to suggest that current quality assurance procedures are contributing to enhanced quality of provision. This must not be seen in

terms of examination performance for there is clear evidence that examinations are being set in such a way that high scores are being generated.

#### **10.2.4 Does quality assurance improve quality**

The third research question was:

- (3) Is there any evidence that current quality assurance procedures are making a contribution in enhancing quality in secondary education in Bahrain?

Overall, implicit in the findings is the suggestion that quality assurance requirements are seen as rather irrelevant and tending to overload the teacher. In fact, the quality assurance system in Bahrain is a foreign adaptation. This means that what has been decided for another educational and cultural background has been implemented in Bahrain with no apparent change to suit best the new environment. It was difficult, in this study to see any evidence that the quality assurance procedures had actually helped quality. None of the perceptions revealed in the survey of the students was reflected in the procedures used in the country. Indeed, this illustrates a major gap in thinking in many cultures where there is little attempt to see if quality assurance actually improves quality for learners. The review of the literature showed no evidence of this except the argument that examination outcomes are indicators of quality, itself a suspect notion.

### 10.3 Strengths and Weaknesses of the Study

These can be summarized (table 10.2).

Strengths	Weaknesses
The large samples in the surveys suggest that the picture gained was an accurate reflection of reality	Time prevent interviewing students or teachers and this would have offered useful insights
The examination data involved very large samples and the deductions from the statistical analyses are, therefore, very robust	It would have been useful to interview some examination setters and those who handled the data centrally to gain their perspectives
The group work units were drawn from materials which had been extensively trialled and were known to be highly effective	The units were all designed for reasons that did not relate to understanding chemistry, the aims being set in generic terms. Time prevented generic outcomes being measured in any way, other than the short survey
	The group work units were so novel for these students that a much longer exposure would have been better
Some very clear pictures were apparent of serious defects in the secondary education in Bahrain and these defects were not being addressed in the current QA system.	Numerous other areas are still needing explored

**Table 10.2 Strengths and weaknesses**

The key issues relate to the extent to which the outcomes are valid. This can be addressed by looking at each approach involved in the study.

It has to be recognized that questionnaires only indicate what respondents *think* and this may or may not reflect reality. In general, if respondents do not suspect any hidden agendas, their responses will be honest but they still may not reflect reality. It is, therefore, important to look at data from questionnaires with caution. For example, the finding that the students asked for group work may or may not indicate that they understood what was entailed in group work. One particular set of group work exercises was employed (and this approach is known to work well: Reid and Yang, 2002; Hussein and Reid, 2009) but the impression was left that, although they were largely effective, the approach was so novel for the students that more experience was needed.

Outcomes from interviews are difficult to summarise. The approach aimed to give the interviewees as much freedom as possible, within a clear framework, so that they could raise issues as they wished. This worked well. However, although every attempt was made to collate the data in line with what they said and how they said it, total objectivity is not easy to achieve.

Finally, in considering the examination data, the analysis here is overtly more objective. Factor analysis is a notoriously complex technique. Principal Components Analysis, using varimax rotation was chosen as this is, perhaps, the most well-attested technique. Very often, outcomes from factor analytic studies require a considerable measure of value judgment. In this case, the criteria were set as very demanding. The outcomes came out very clearly and there is extremely strong evidence to suggest a high level of confidence in the findings.

#### **10.4 Future Work**

Finally, there are suggestions for further work that needs to be conducted:

- 🏆 Explorative research (through interviews with more open questions) which looks at students' perceptions about their expectations from their school education.
- 🏆 Explorative research (through interviews with more open questions) looking at teachers' views to shed light on their needs, the way in which they are being evaluated and their suggestions.
- 🏆 Exploring the views of examination setters (through interviews with more open questions) to gain insight on the criteria and measures taken in the process of national examination development.
- 🏆 Investigate the impact of a much longer exposure to group work on student's comprehension and critical skills not only in chemistry but in other subjects as well.

## 10.5 Recommendations

This research revealed that there are six important areas which are worth exploring in the future and which are, perhaps, generic in all school systems but in varying degrees.

First, learners want to learn through understanding (Almadani *et al*, 2011) whereas their school learning approaches emphasise recall. Therefore, this issue needs to be addressed through re-examining the national curricula and the way national examinations are set.

Second, the current curriculum in Bahrain requires the incorporation of group-work teaching and learning approaches. There is an urgent need to look closely at group-work and how group-work tasks can be included in the syllabus.

Third, there is also the need to re-consider the whole area of the visual-spatial learning.

Fourth, with regard to science education, the time given to these subjects and how these subjects are presented needs to be re-considered.

Fifth, the present educational system in Bahrain requires the need to seriously re-examine curricula and teaching approaches to assess their contribution to the development of thinking skills, and to challenge and generate creative thought.

Sixth, the national examination system in Bahrain needs to be re-examined in terms of the following points.

- (a) Examiners need to be taught that marks have no absolute value;
- (b) Examination setters need to be trained to set standards which will give acceptable means and standard deviations;
- (c) All marks in all subjects need to be standardised on to some suitable scale;
- (d) The emphasis on recall needs to be replaced by an emphasis on other more important skills, understanding being important;
- (e) Examiners in English need consulted to see why they are doing things better.



These six recommendations may well be important to consider not only in Bahrain but in other countries as well. However, the big question always has to be whether the procedures of quality assurance have indeed improved quality. The answer to that is still ambiguous and may well be one of the most challenging areas for enquiry for educators in the 21<sup>st</sup> century (Almadani *et al*, 2011).

## 10.6 Endpiece

Quality assurance has become important in education. However, its role in this context is not clear, especially in terms of the experiences and achievements of learners. Bahrain is investing heavily in this system, wishing to see a great deal of improvement in its citizens' education. This thesis has investigated to what extent that investment has been beneficial to the Bahraini learner, particularly in secondary education.

The main findings revealed that there is a major lack of consistency and shared understanding between those who take the decisions in education (and the documentation they generate) and the realities of what goes on in schools (as reflected by teachers and learners). There is a need to focus on the learners, their experiences, their achievements and their needs as they move out into higher education or the workplace. There is a need to widen the range of skills being assessed and to develop resources to enable these skills to grow. Above all, the role of quality assurance in Bahrain has to be one that empowers the teachers rather than inspects them and criticises, often on matters over which teachers have no control.

It is hoped that this study has made a contribution that can enable the secondary education provision in Bahrain to move forward to an exciting future for the benefit of all the stakeholders.

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## **Appendix 1**

### **Surveys (In English, reduced in size)**

### Quality Assurance in Secondary Education in Bahrain

*This survey seeks to find your views about quality assurance in secondary education in Bahrain.  
It is a research study being conducted in the University of Dundee, Scotland  
The outcomes may guide the development of future procedures.  
Your answers will be treated with total confidentiality*

Are you: ☐ Teacher ☐ Senior Teacher ☐ Head Teacher

Are you: ☐ Male ☐ Female

Name of school: .....

\*\*\*\*\*

- (1) What are your opinions about your *experiences in quality assurance in education*?

Tick **ONE** box on each line to show your view

Useful						Not useful
Not helpful						Helpful
Understandable						Not understandable
Satisfying						Not satisfying
Has not improved education						Has improved education
Difficult to carry out						Easy to carry out
Mostly done						Often omitted
Important						Not important
Well organized						Not well organized
Irrelevant in education						Essential in education

- (2) Here are several reasons *why quality assurance in education is important in teaching and learning*?

Place a tick against the **THREE** reasons which you think are the **most important**.

Quality assurance in education:

- ☐ Aims to makes teaching and learning more enjoyable.  
☐ Enables standards to be checked.  
☐ Aims to introduce new methods into teaching  
☐ Ensures that all schools follow the same procedures.  
☐ Aims to produce better examination results  
☐ Ensures that all teachers do the same things.  
☐ Makes the theory of teaching more obvious.  
☐ Improves teaching skills.  
☐ Aims to produce better educated students.  
☐ Generates more freedom for teachers.

- (3) For training in quality assurance in education for developing teaching and learning, *which do you prefer*?

☐ On-going training
 ☐ Training at start
 ☐ No need for training

- (4) Tick the box *which most closely reflects* your views?

Tick **ONE** box on each line.

	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
(a) I feel that the quality assurance system (evaluation) in education works well.					
(b) There is not enough discussion in my school about the quality assurance system in education.					
(c) Using quality assurance system in education helps me do things more accurately.					
(d) The quality assurance system in my school helps me use more varied teaching methods.					
(e) I am not involved with the quality assurance system in my school.					
(f) A quality assurance system is essential in education to achieve good standards.					
(g) I feel using a quality assurance system in education is difficult.					
(h) I consider using the quality assurance system in education in teaching is a waste of time.					
(i) The instructions and guidelines of the quality assurance system in education are clear to me.					
(j) The Ministry of Education does not follow up the findings from quality assurance.					
(k) The quality assurance system does not focus enough on the most important aspects of education.					
(l) The quality assurance system has improved my skills as a teacher.					
(m) I should like the quality assurance system to include more practical training programmes.					
(n) The quality assurance system has improved the educational experiences of my students.					

- (5) Quality assurance can be carried out by many people. Look at the list below.  
Tick **three descriptions** which you consider would be *most helpful in ensuring high quality education*.

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Visits by school inspectors  | <input type="checkbox"/> Visits by education managers | <input type="checkbox"/> Schools compared by visitors |
| <input type="checkbox"/> Examination results analysed | <input type="checkbox"/> Outsiders visiting schools   | <input type="checkbox"/> Schools helping each other   |
| <input type="checkbox"/> Teachers being trusted       | <input type="checkbox"/> Head teachers being trusted  | <input type="checkbox"/> No formal quality assurance  |
| <input type="checkbox"/> School students being asked  | <input type="checkbox"/> Classes being observed       | <input type="checkbox"/> Resources being analysed     |

- (6) Tick the box **which most closely reflects** your views?  
Tick **ONE** box on each line.

	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
(a) The curriculum plan for my subject is clear.					
(b) I have been trained in the curriculum for my subject.					
(c) The textbooks in my subject cover the curriculum well.					
(d) There are good training programmes to enable me to teach my subject.					
(e) The syllabus has been distributed to me on time.					
(f) There is guidebook for teaching my subject.					
(g) There is a good guidebook for practical work in my subject.					
(h) The textbooks in my subject make the subject accessible for my students.					
(i) The curriculum in my subject is appropriate for my students.					
(j) The national examinations test my subject well.					
(k) My students pass the national examinations in my subject by having good memories.					
(l) The papers in the national examinations in my subject are too long.					
(m) The national examinations in my subject are not linked enough to the textbooks.					
(n) The education in my subject is a good preparation for life.					

**Thank you for Helping**



## Secondary Education in Bahrain

### How You See Your School Experiences

*This survey seeks to find your views about you see your school experiences  
It is a research study being conducted in the University of Dundee, Scotland  
The outcomes may guide the development of future developments in schools  
Your answers will be treated with total confidentiality*

Are you: ☐ Male☐ Female

Name of school: .....

\*\*\*\*\*

<div style="display: flex; justify-content: space-between;"> <div>             quick <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> slow              important <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> unimportant              safe <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> dangerous           </div> <div style="border: 1px solid black; padding: 5px; font-size: 0.9em;">             The position of the ticks between the pairs show that you consider it as <i>very</i> quick, <i>slightly more important</i> than unimportant and <i>quite</i> dangerous.           </div> </div>
---

It is possible to describe a racing car in this way:  
Use the same method in questions (1), (2) and (3).

- (1) What are your opinions about
- learning in school**

*Tick one box one each line*

I feel I am coping well	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I feel I am not coping well
I am not enjoying school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I enjoy school
I have found school work easy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I have found school work difficult
My school results are getting worse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	My school results are getting better
School is giving me benefits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	School is giving me no benefits
Work at school is relevant to my needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Work at school is irrelevant to my needs
My parents are interested in my education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	My parents are not interested in my education

- (2) What are your opinions about
- your preferred way of learning**
- .

*Tick one box one each line*

I find my textbooks unhelpful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I find my textbooks helpful
Examinations do not help me to learn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Examinations help me to learn
I enjoy practical work at school	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I do not enjoy practical work at school
I like the way the school is run	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I do not like the way the school is run
School shows me what to memorise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	School shows me what to understand
Most subjects at school are useful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Most subjects at school are not useful
I prefer working on my own	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I prefer working with others

- (3) Think of
- your school experience**
- during the
- last 12 months**
- .

*(Tick one box on each line)*

I enjoyed it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I hated it
It was too easy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	It was too difficult
It helped me to think of possible careers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I still do not have a clear career direction
There was not enough time in science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There was too much time in science
I did well in my exams	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	I did badly in my exams
My best marks came in arts subjects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	My worst marks came in arts subjects

- (4) You will like some subjects better than others.

- (a) What is your favorite subject: .....
- (b) What is your second favorite subject:.....
- (c) What subject do you like least ? .....
- (d) Thinking of your favorite subject, explain why you like it best:.....

- (5) Think of your
- recent school experiences**
- .

*Tick one box on each line.*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(a) My school is well equipped to help me learn well.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) My school does not have enough computers to help our learning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) I like examinations where I have the opportunity to show that I have ideas of my own	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) I prefer to learn the facts and then be tested on what I remember.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) In order to pass my examinations, I need to study just what the teacher tells me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) We cannot call anything scientific knowledge unless it is absolutely true.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) I believe it is the job of the teacher to supply me with all the knowledge.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(h) All I have to do in science is to memorise things.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(i) My school is preparing me well for later life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(j) In exams, I like questions which give me the scope to go beyond what is taught and show my ability to think.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- (6) Think about the way **you like to learn**.  
Tick *one box* on each line.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(a) I prefer to learn by reading books.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(b) I often see ideas in terms of mental pictures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(c) I like to understand things rather than simply memorise them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(d) I like subjects where things are clearly right or wrong.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(e) I find I rely heavily on clear explanations from the teacher.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(f) I learn best when I do things for myself.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(g) I like doing subjects which involve calculations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- (7) Here are some reasons for choosing coursing various courses.  
Tick **all** the reasons that are true for you

- |  |   |
|--|---|
| <input type="checkbox"/> I do not like science subjects                          | <input type="checkbox"/> Mathematics is my best subject                             |
| <input type="checkbox"/> I like learning languages                               | <input type="checkbox"/> My teacher encouraged me                                   |
| <input type="checkbox"/> I think my course will lead to good jobs                | <input type="checkbox"/> I find the sciences too difficult                          |
| <input type="checkbox"/> I am doing what parents encouraged me to do             | <input type="checkbox"/> The subjects are important for study for my chosen career. |
| <input type="checkbox"/> I like doing practical things                           | <input type="checkbox"/> I think my course will help me to understand the world.    |
| <input type="checkbox"/> These subjects are the ones where I gain the best marks |   |

- (8) Here are ways you can learn.  
Tick the **two** that you find **most helpful**.

- |   |  |
|---|--|
| <input type="checkbox"/> My teacher lecturing | <input type="checkbox"/> Working in a group                        |
| <input type="checkbox"/> Reading my textbook  | <input type="checkbox"/> Doing practical activities                |
| <input type="checkbox"/> Working at home      | <input type="checkbox"/> Questions and discussion with the teacher |

- (9) Imagine you were in charge of your entire school.

Suggest **one thing** you would like to change.

*Thank you for Helping*

**Appendix 2**  
**Interview Schedule**  
**(In English)**

## Interview Outline

### ***Section One: Interviewee Background***

- (1) Job Title and Position: .....
- (2) Gender ☐ Male ☐ Female
- (3) Your highest qualification:  
☐ PhD ☐ Master ☐ Bachelor ☐ Diploma ☐ Below Diploma
- (4) Years of total experience:  
☐ Less than 6 ☐ 6 -10 ☐ 11-15 ☐ 16 -20 ☐ More than 20
- (5) Years of experience in the current position:  
☐ Less than 6 ☐ 6 -10 ☐ 11-15 ☐ 16 -20 ☐ More than 20
- (6) Number of in-service training courses during past two years:  
☐ None ☐ 1 – 5 ☐ 6 – 10 ☐ 11 – 15 ☐ More than 15
- (7) Number of training courses in quality assurance in education that you have undertaken:  
☐ None ☐ One ☐ Two ☐ Three ☐ More than three

### ***Section Two: Interviewee's View***

- (1) What you think is the main aim for quality assurance?
- (2) Describe your role in quality assurance at secondary school stages:
- (3) Describe how you see the strengths and weaknesses of the present system:
- (4) What is your experience of training in the context of quality assurance? Is it important, essential or what?
- (5) How did you find the user guide? What are its strengths and weaknesses?
- (6) In the past, there was no quality assurance. What changes has the introduction of quality assurance made? Are these beneficial or otherwise?
- (7) Suppose quality assurance was now removed. What differences would you notice?
- (8) Talk about quality assurance as it affects:
  - (a) The curriculum:
  - (b) Pupil achievements:
  - (c) Quality of resources:
  - (d) Quality of teaching:
  - (e) Quality of school leadership:

**Appendix 3**  
**Group Work Units**  
**(In English)**

**Unit 1 Which is the Best Fuel?**

**You will be working in a small group.**

**Discuss the possible answers to the questions below and one member of the group can write in your agreed answers on to the "Answer Sheet".**

There are three important fuels which can give you energy.

- (1) Coal - which contains the element carbon, C
- (2) Oil - a hydrocarbon mixture, mainly  $C_{11}H_{24}$
- (3) Gas - mainly methane,  $CH_4$

Which of these is likely to give you the most energy?



*For you to talk  
about .....*

**Part 1**

Write balanced equations for the complete combustion of each fuel. Make sure you agree on the answers before filling in your answer sheet.

**Part 2**

Calculate the formula masses of each of the fuels. Write down your agreed answers.

**Part 3**

Assume that the energy released is related to the number of molecules formed. In other words, the more molecules formed, the greater the energy released.

Suppose you were given 1 Kg (=1000g) of each fuel, which fuel would give you most energy?

Discuss, as a group, how you might tackle this problem before you start.

You won't need to use a calculator - just carry out rough calculations.

**Part 4**

You were told to assume that the energy released is related to the number of molecules formed. Is this a fair assumption? Write down the thoughts of your group on your answer sheet.

## Unit 2 The Glowing Splint Problem

**You will be working in a small group.**

**Discuss the possible answers to the questions below  
and one member of the group can write in your  
agreed answers on to the "Answer Sheet".**

Nitrogen dioxide (NO<sub>2</sub>) is a gas which can be found in car exhaust fumes. It can be broken up in the car exhaust.

When the NO<sub>2</sub> is broken up in the exhaust, what gases are formed ?

Experiments have shown that:

- (1) Air contains approximately 20% oxygen plus 80% nitrogen.
- (2) Oxygen re-kindles a glowing splint.
- (3) Neither air nor NO<sub>2</sub> will re-kindle a glowing splint



***For you to talk  
about .....***

Look at the following experiment:

Copper (II) Nitrate (a solid) breaks up when heated to give copper (II) oxide (a solid), nitrogen dioxide and oxygen. The balanced equation is:



The gases coming out of the test tube contain 80% nitrogen dioxide and 20% oxygen but it is found that they will re-kindle a glowing splint.

Look at all the information given to you. *Working as a group*, discuss possible answers to the following questions:

- (1) Why is this an unexpected result ?
- (2) Can you suggest a possible explanation for this?

**Unit 3 Moving Gases**

**You will be working in a small group.**

**Discuss the possible answers to the questions below  
and one member of the group can write in your  
agreed answers on to the "Answer Sheet".**

Have you ever smelled the perfume from someone immediately after they entered the room? This is because the particles of perfume are travelling through the air and have reached your nose. All gases travel but they do not all travel at the same speed. It has been found that different gases travel different distances in the same time.

The following data were collected from an experiment. The distances travelled by various gases in a set amount of time through a horizontal glass tube were observed. This was done at room temperature and the same pressure for all the gases.

Gas	Distance (cm)
SO <sub>2</sub>	50
CH <sub>4</sub>	100
HCl	66
SO <sub>3</sub>	44
NH <sub>3</sub>	94



***For you to talk  
about .....***

- (1) Look at the results as a group and see if you can spot any pattern in these results?
- (2) How would you test to see if your pattern is correct?
- (3) Predict how far you would expect chlorine gas (Cl<sub>2</sub>) to travel under the same conditions.



## Unit 4 The Formula for Ozone

**You will be working in a small group.**

**Discuss the possible answers to the questions below  
and one member of the group can write in your  
agreed answers on to the "Answer Sheet".**

We sometimes hear about ozone gas in the news. The gas exists in small amounts in the upper atmosphere of the Earth. It is incredibly important for it absorbs harmful ultra-violet radiation from the sun. If it was not there, we would all be badly affected by the radiation and many would develop cancers.

What is Ozone ? To find out what ozone is, we shall first look at several other gases.



*For you to talk  
about .....*

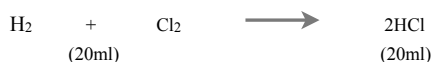
## Part 1

Look at the following reactions, shown by balanced equations:

- (a) 20 ml of ammonia breaks down to give 40ml of a mixture of nitrogen and hydrogen.



- (b) 20 ml of a 50:50 mixture of hydrogen and chlorine reacts to give 20ml of hydrogen chloride gas.



- (1) Try to work out what volume (in ml) of carbon dioxide will be produced in the following reaction.



- (2) At about 450° C, phosphorus gas molecules (P<sub>4</sub>) break up according to the following equation:



What is the formula of phosphorus gas above 450° C ?

*At this stage, check your answers with your teacher.*

## Part 2

Ozone is a gas. In a series of experiments, it can be shown that, for every 20ml of ozone that break up, 30 ml of oxygen is formed. Surprisingly, no other element is involved.



Given that the formula for Oxygen is always O<sub>2</sub>, can you work out the likely formula for Ozone ?

How did you find out your answer ? Write down your group's way of finding the answer on your answer sheet.

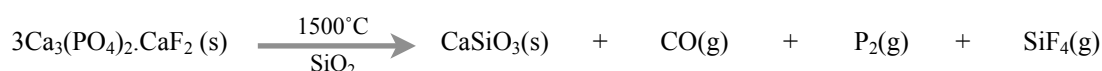
## Unit 5 The Phosphorus Problem

**You will be working in a small group.**

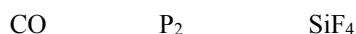
**Discuss the possible answers to the questions below  
and one member of the group can write in your  
agreed answers on to the "Answer Sheet".**

Phosphorus is made in industry from rock phosphate which has the following complicated formula:  $3\text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaF}_2$

The reaction is:



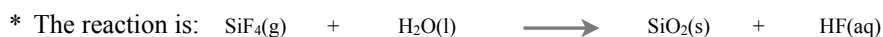
When heated to a temperature of  $1500^\circ\text{C}$  with carbon (coke) and silicon dioxide (sand), the following gases are produced:



In the reaction furnace, there are four main products and the problem is to separate them in order to obtain pure phosphorus. The difficulty is that phosphorus catches fire immediately on contact with air.

Here is some information to help you:

Compound	Melting Point ( $^\circ\text{C}$ )	Boiling Point ( $^\circ\text{C}$ )	Reaction with Water	Reaction with Air	Density ( $\text{gcm}^{-3}$ )
$\text{CaSiO}_3$	$\sim 1540$	Not known	Insoluble, no reaction	None	2.9
$\text{CO}$	-199	-191	Insoluble, no reaction	Burns	1.25
$\text{P}_2$	44	280	Insoluble, no reaction	Burns violently	1.82
$\text{SiF}_4$	-90	-86	Reacts *	Reacts with dampness in air	4.69



***For you to talk  
about .....***

Try to work out a way to obtain pure phosphorus solid which is uncontaminated by the other three products. Remember that the phosphorus must always be kept away from air. [You may find out helpful to use pictures or diagrams.]

Write down your agreed answers on your answer sheet.

## Unit 6 Salt, Salts, and pH

**You will be working in a small group.**

**Discuss the possible answers to the questions below  
and one member of the group can write in your  
agreed answers on to the "Answer Sheet".**

When you use the word "salt", you probably think of sodium chloride, the white substance you put on your chips. However, sodium chloride is just one of a huge number of compounds that are known as "salts".

Salts are usually made up of a metal 'bit' and a 'bit' that comes from an acid. Not all salts will dissolve in water but here is a list of some salts and the pH of the solutions obtained by some school students when they dissolved them in water.

Salt	pH
Iron (II) sulphate	1
Aluminium chloride	3
Zinc (II) sulphate	3
Copper (II) nitrate	3
Sodium chloride	7
Potassium sulphate	7
Calcium chloride	7
Sodium nitrate	7
Sodium carbonate	10
Potassium carbonate	11



***For you to talk  
about .....***

It is possible to draw many conclusions from the above table. For example, salts containing potassium (K) always seem to have a pH of 7 or more. We say that the  $\text{pH} \geq 7$ .

Working as a group, see how many other conclusions you can draw from the table of results. Write down your agreed answers.

## Unit 7 Solubility

**You will be working in a small group.**

**Discuss the possible answers to the questions below  
and one member of the group can write in your  
agreed answers on to the "Answer Sheet".**

Different compounds tend to dissolve in water to different extents.

Here is a table of solubility of some salts, expressed in grams per 100 grams of solution at room temperature.

	OH <sup>-</sup>	F <sup>-</sup>	Cl <sup>-</sup>	CO <sub>3</sub> <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>
Na <sup>+</sup>	109	4	36	21	87	19
K <sup>+</sup>	112	95	35	112	32	11
Mg <sup>2+</sup>	0.0009	0.008	54	0.011	70	33
Ca <sup>2+</sup>	0.16	0.0016	75	0.002	129	0.21
Ba <sup>2+</sup>	14	0.12	36	0.002	9	0.0002
Pb <sup>2+</sup>	0.016	0.064	0.99	0.001	55	0.004
Zn <sup>2+</sup>	0.85	1.62	420	0.001	184	96
Ag <sup>+</sup>	decomposes	195	0.0001	0.003	217	0.8
Fe <sup>2+</sup>	0.0002	not known	70	0.007	84	20

Look at the first number at the top left in the table. It tells us that if we have sodium hydroxide (NaOH), then we can expect 109g to dissolve in 100g of water at room temperature.

Compounds can be divided into three groups:

Giving more than 10 g in 100 g of solution are called	<i>"soluble"</i>
Giving less than 1 g in 100 g of solution are called	<i>"insoluble"</i>
Giving between 1g and 10g in 100g of solution are called	<i>"slightly soluble"</i>



***For you to talk  
about .....***

- (1) Can you see any patterns in these results ? As a group, write down as many patterns as you can.
- (2) You have been given the information about compounds of magnesium, calcium and barium. Look at your periodic table. You can see the element strontium (which is less common but was found first in Scotland). You have not been given any information about strontium. Using the table above, predict the approximate solubility (using numbers) that you would expect for strontium hydroxide and strontium sulphate. Write down your agreed answers.
- (3) If you were to mix a solution of magnesium chloride with a solution of potassium hydroxide, predict what might happen. Write down your agreed answer.

## Unit 8 Trees and Cars

**You will be working in a small group.**

**Discuss the possible answers to the questions below  
and one member of the group can write in your  
agreed answers on to the "Answer Sheet".**

The following statement appeared in a well known American newspaper. It was concerned with ways to absorb carbon dioxide from the air.

"One tree can use up about 6 kg of carbon dioxide per year or enough to offset the pollution produced by driving one car for 42,000km."

**Is the quotation from the newspaper correct?**

You are given the following information:

- \* Petrol is mainly octane [ $C_8H_{18}$ ].
- \* An average small car gets about 10 km per litre of petrol.
- \* Octane weighs 700g per litre.



***For you to talk  
about .....***

- (1) As a group, discuss how you might attempt to answer this question-write down a plan. If you are completely unsure what to do, *ask for a hint*.
- (2) When you have a plan, if you find difficulty at any stage, *ask for a hint*.  
Remember: you want to find out if one tree in one year can use up the carbon dioxide produced by an average small car in one year.
- (3) You will need a calculator. Work as group, using rough calculations only.

## Unit 9 Bonding

**You will be working in a small group.**

**Discuss the possible answers to the questions below and one member of the group can write in your agreed answers on to the "Answer Sheet".**

The properties of a substance depend on its structure: the way its atoms, molecules or ions are arranged and held together.

The properties of compounds with different types of bonding are summarised below.

Type of Bonding	Melting Point	Boiling Point	Electrical Conductivity	Solubility in Water
<b>Covalent</b>	Tend to be low occasionally very high	Low or extremely high	Poor	Varies
<b>Polar Covalent</b>	Tend to be low	Low or high	Usually poor, some react with water to give conduction	Usually soluble but some react
<b>Ionic</b>	High	Very high	Good melted Good dissolved Poor as a solid	Often soluble
<b>Metallic</b>	Usually high	Very high	Very good	Usually insoluble

Your problem is to work out a way to find out what type of bonding exists in aluminum chloride for which a possible formula might be:  $\text{AlCl}_3$



***For you to talk about .....***

As a group, you have 200 Dinars to spend to buy the results of various experiments. You can spend less than 200 Dinars but you may not spend more!

Here is the price list:

Test	Description	Cost
1	Measure melting point	55 dinars
2	Measure boiling point	25 dinars
3	Measure solubility	60 dinars
4	Measure electrical conductivity as dissolved	40 dinars
5	Measure electrical conductivity as melt	80 dinars
6	Reaction with water	65 dinars

- (1) Discuss what results you want to buy to help you find out the type of bonding in aluminum chloride. You can buy them altogether or you can buy them one at a time. **Ask your teacher for the results that you choose.**
- (2) Now try to work out the type of bonding in aluminum chloride, writing down how you have worked out your answer.

## Unit 10 The Marvels of Growing Hair

**You will be working in a small group.**

**Discuss the possible answers to the questions below and one member of the group can write in your agreed answers on to the "Answer Sheet".**

We all have hair on our heads and time grows all the time. From time time, it needs to be cut. Have you ever thought about what is happening when your hair grows?

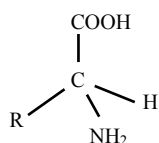
Hair is a polymer of protein. In this, amino acid units (the monomers) link together to form enormous molecules which then group together in strands to give us what we know as hair.

As our hair grows, new amino acid units are being linked on to the base of our hair and pushing out the hair endlessly, all day and all night.

The problem for your groups is to estimate how many amino acid units get added onto one single protein molecule each second.

You are free to discuss the problem in any way you wish. You have about 30 minutes.

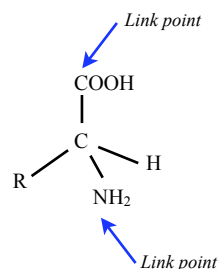
However, here is the structure of an amino acid molecule, showing its correct shape:



*The COOH group of one molecule links to the NH<sub>2</sub> group of the next molecule to give a chain.*

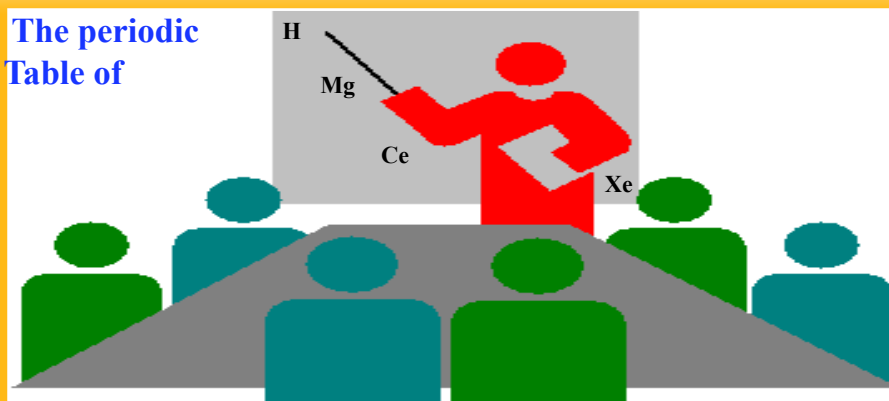
*The 'R' symbol stands for an attachment that can vary from amino acid to amino acid.*

*The typical length of a bond between two atoms is about 150 picometres ( $10^{-12}$  m).*



Now discuss together how you can work out how many amino acid units attach to a strand per second as your hair grows. You may be surprised. You will need a calculator.

Unit 11  
The Periodic Table of Elements



How to Use this Booklet

- 👤 Read the booklet carefully.
- 👤 Stop at the questions and *discuss* possible answers with other members of your group.
- 👤 Write down your *agreed* answers.
- 👤 You may need to look up books or search the world-wide web using a computer.
- 👤 You can keep this set of sheets.
- 👤 Your work will NOT be marked by anyone.
- 👤 Possible answers to the questions will be provided at the end.
- 👤 Only use these ***after*** you have tried your best to find the answers.

***Working in Groups***

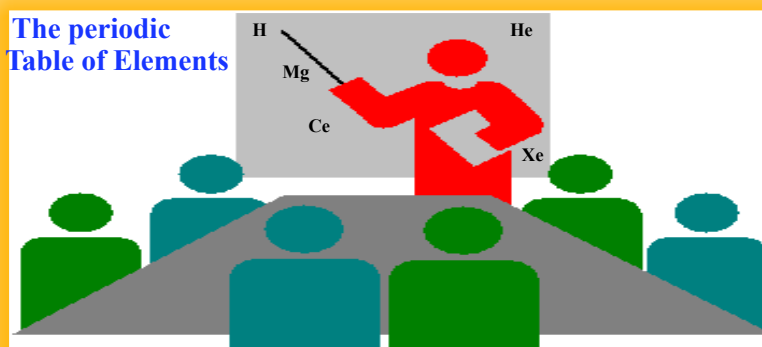
*This booklet is designed to help you understand the periodic table of the elements.*

*It is designed so that you can work in a small group.*

*Discuss the possible answers to the questions.*

*Then, write in your agreed answers.*





### How did it all Start ?

The first suggestion that all matter was made up of very small particles was made by the Greek philosopher, Democritus, in 440BC. He asked the question, “*if I cut this object in half and then each bit in half, can I go on forever?*” He suggested that there would come a time when he would be down to the fundamental particles. They would be ‘uncuttable’. The Greek word for ‘uncuttable’ is ‘atomos’. This gave us our word ‘atom’.

Centuries later, the English scientist John Dalton took the very careful measurements made in the late 18<sup>th</sup> century by the French chemist Antoine Lavoisier and deduced that all matter was made up of atoms in specific and fixed proportions. He started to use the word ‘atom’.

By the early nineteenth century, the idea that there was a number of different atoms was well accepted. These were known as the elements. It was known that atoms of some elements were heavier than the atoms of others. Jons Jacob Berzelius, in Sweden, then showed that it was possible to compare the weights of atoms of different elements and compare them to the weight of a hydrogen atom.

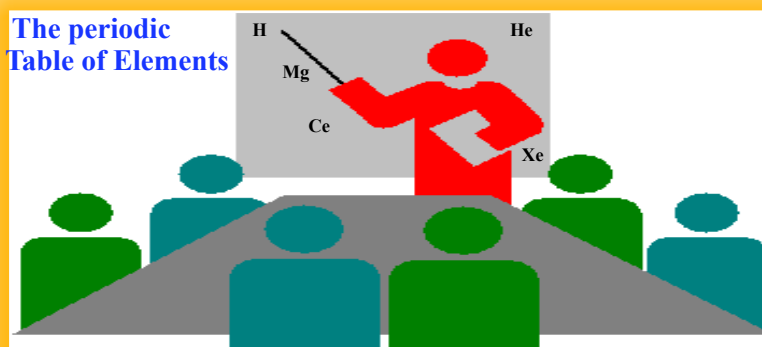
These relative weights became known as atomic weights. Today we use the phrase atomic mass and to show that we are simply comparing the masses, we use the phrase, ‘*relative atomic mass*’. People now started to look for patterns in the elements.

In 1829, Wolfgang Dobereiner, of Germany, noticed that, in some groups of three chemically similar elements (for example, Cl, Br, I; Ca, Sr, Ba; S, Se, Te), the relative atomic mass of the middle element is nearly midway between those of the first and last. The way the middle element behaved also seem to be ‘*half way*’ between the outer two. These ‘*triads*’ (groups of three) were probably the first attempt at looking for patterns among the elements.

In order to try to sort things out, Friedrich Kekule organised the First International Chemical Congress in Germany in 1860. This was the first ever international gathering of scientists. The most important lecture was given by an Italian, Stanislao Cannizzaro, who persuaded his listeners of the importance of accurate values of atomic masses.

In the next few years, several chemists began to list the known elements in the order of their relative atomic masses. A few of them noticed that, certainly to begin with, every eighth element had similar properties. The great breakthrough came in 1869. The Russian chemist, Dmitri Mendeleev (followed by the German, Julius Lothar Meyer, the following year), suggested that placing all the known elements in order of their relative atomic masses led to behaviour patterns repeating themselves.

This is the idea of periodicity and was presented by Mendeleev as a periodic table of the elements. The word ‘periodic’ was used because he found that there was a repeat pattern after 8 elements.



### Is the Periodic Table Useful?

When Mendele'ev first proposed his periodic arrangement of elements by their atomic masses, he had no idea why the different elements had different atomic masses. Neither could he explain the behaviour of the elements.

At the beginning of the twentieth century, scientists discovered the structure of the atoms and showed that the atomic *number* of an element is more important than the relative atomic mass of the element. The atomic number is the number of protons in one atom of each element.

Thus, today, the Periodic Table is arranged so that it tells not only the properties of the elements but also about the number of protons in their atoms. In addition, we now understand why elements are arranged in the patterns of the periodic table, because we have a clear understanding of the structure of individual atoms, and how the arrangement of the electrons in different energy levels affects the reactivity of the elements.

#### Do you Know that ?

Element 101 was named Mendelevium (Md),  
Asteroid 2769 was named after Mendele'ev.  
The Russian Scientific Ship is called the *Dmitriy Mendeleev*

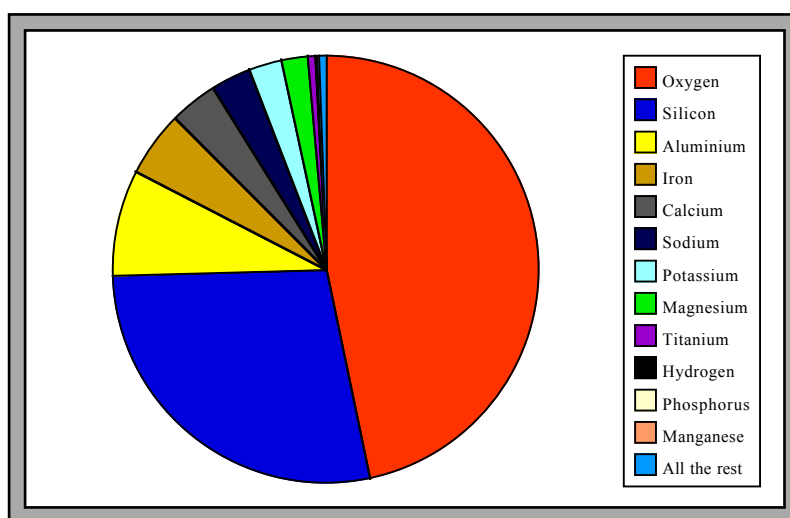
One way to make our life easier is to put things with similar behaviour into groups. For example, in supermarkets, the milk products are grouped together in the same place while the cleaning products are grouped together in a different place. The usefulness of this classification is to help customers find the kind of products they want easily.

There are over 100 elements. Can you remember the behaviour of all of these elements? That's more or less an impossibility!! The Periodic Table sorts the elements into families (they are called **groups**) and each group lies in a column. However, there are many patterns and trends which are found to exist in both the groups and also in the rows of the elements. Today, we can often understand why these patterns exist. However, the periodic table was first formed simply by placing the elements in order of the atomic mass of the elements by Mendele'ev. Today's periodic table has the elements in order of atomic number (which gives almost the same order as that obtained using atomic mass).

Let's now look at some simple patterns in the periodic table.

## How Common are the Elements ?

Amazingly, most of the earth's crust (the air, the sea and water, the rocks to a depth of about 5 miles) is made up of only 12 of the elements:



The Periodic Table shows most of the elements, with colours to show how common they are.

<sup>1</sup> H		<div>Do not worry about the strange shape, with the gap in the middle. This will become clearer later.</div>																<sup>2</sup> He	
<sup>3</sup> Li	<sup>4</sup> Be											<sup>5</sup> B	<sup>6</sup> C	<sup>7</sup> N	<sup>8</sup> O	<sup>9</sup> F	<sup>10</sup> Ne		
<sup>11</sup> Na	<sup>12</sup> Mg											<sup>13</sup> Al	<sup>14</sup> Si	<sup>15</sup> P	<sup>16</sup> S	<sup>17</sup> Cl	<sup>18</sup> Ar		
<sup>19</sup> K	<sup>20</sup> Ca	<sup>21</sup> Sr	<sup>22</sup> Ti	<sup>23</sup> V	<sup>24</sup> Cr	<sup>25</sup> Mn	<sup>26</sup> Fe	<sup>27</sup> Co	<sup>28</sup> Ni	<sup>29</sup> Cu	<sup>30</sup> Zn	<sup>31</sup> Ga	<sup>32</sup> Ge	<sup>33</sup> As	<sup>34</sup> Se	<sup>35</sup> Br	<sup>36</sup> Kr		
<sup>37</sup> Rb	<sup>38</sup> Sr	<sup>39</sup> Y	<sup>40</sup> Zr	<sup>41</sup> Nb	<sup>42</sup> Mo	<sup>43</sup> Te	<sup>44</sup> Ru	<sup>45</sup> Rh	<sup>46</sup> Pd	<sup>47</sup> Ag	<sup>48</sup> Cd	<sup>49</sup> In	<sup>50</sup> Sn	<sup>51</sup> Sb	<sup>52</sup> Te	<sup>53</sup> I	<sup>54</sup> Xe		
<sup>55</sup> Cs	<sup>56</sup> Ba	<sup>57</sup> La	<sup>72</sup> Hf	<sup>73</sup> Ta	<sup>74</sup> W	<sup>75</sup> Re	<sup>76</sup> Os	<sup>77</sup> Ir	<sup>78</sup> Pt	<sup>79</sup> Au	<sup>80</sup> Hg	<sup>81</sup> Tl	<sup>82</sup> Pb	<sup>83</sup> Bi	<sup>84</sup> Po	<sup>85</sup> At	<sup>86</sup> Rn		
<sup>87</sup> Fr	<sup>88</sup> Ra	<sup>89</sup> Ac																	
			Colour		Element														

Colour	Element
	Oxygen and silicon: about 75% of the Earth's crust
	The next 10 - the really common elements
	Quite common
	Well known elements
	Not so common
	Rare enough to be highly valuable
	The rare elements
	The extremely rare elements



*For you to talk  
about .....*

- (1) Almost 75% of the Earth's crust is made up of the elements **oxygen** and **silicon**.  
Where (air, sea, water and/or rocks?) might you find these elements in the earth's crust?

*Oxygen is in found*

*in:* .....

*Silicon is in found*

*in:* .....

- (2) Look at the elements shaded dark green. After oxygen and silicon, these are the top ten most common elements.  
Are there any surprises and can you explain why they are there?

*Surprises:* .....

*Reasons:* .....

- (3) Many of the elements in columns I and II are common.  
Where would you find these elements (air, sea, water or rocks?) ?

.....

- (4) Why are **rare** elements like silver, gold, platinum, helium and neon so well known?

.....

.....

- (5) Look at element 38 - Strontium.  
Use the internet or books to find as much as you can about this element.  
In what country was it discovered? After what was it named? Has it any uses?

.....

.....

.....

## How Did you Get on ?

- (1) *Almost 75% of the Earth's crust is made up of the elements oxygen and silicon. Where (air, sea, water or rocks?) might you find these elements in the earth's crust?*

Oxygen is found in the air, and in water (including, of course, the sea). It is also found in most rocks (the most common rocks are silicates). Silicon occurs in silicate rocks and also as silicon dioxide (sand is silicon dioxide and some other rocks also are mainly silicon dioxide eg. quartz, agates).

- (2) *Look at the elements shaded dark green. After oxygen and silicon, these are the top ten most common elements. Are there any surprises and can you explain why they are there?*

Perhaps the most surprising one is titanium. This is extremely common, occurring as the dioxide ( $\text{TiO}_2$ ). Titanium oxide, when pure, is the whitest substance known and is used in all brilliant white paint. It is very difficult to convert the titanium dioxide to titanium metal as this takes an enormous amount of energy. Therefore, titanium metal is quite rare. However, it is incredibly useful, being as strong as steel, with half the density of steel. It also does not rust and it can be dyed to give colour effects. It is used in expensive parts in aircraft, in Olympic bicycles and in making very attractive jewellery. It is also used in making spectacles.

- (3) *Many of the elements in columns I and II are common. Where would you find these elements (air, sea, water or rocks?)*

Most of the metals are found combined with other elements in rocks and in the sea. Lithium, sodium, potassium, rubidium and caesium are mainly in the sea, while strontium and barium are mainly in rocks. Magnesium and calcium occur in both the sea and in rocks. Beryllium is rare and occurs in rocks. Have you ever thought why these metals are found mainly in the sea? Elements are only found in the sea if their compounds are soluble in water and can be washed off the land. Column 1 metal compounds tend to be very water soluble so are found mainly in the sea.

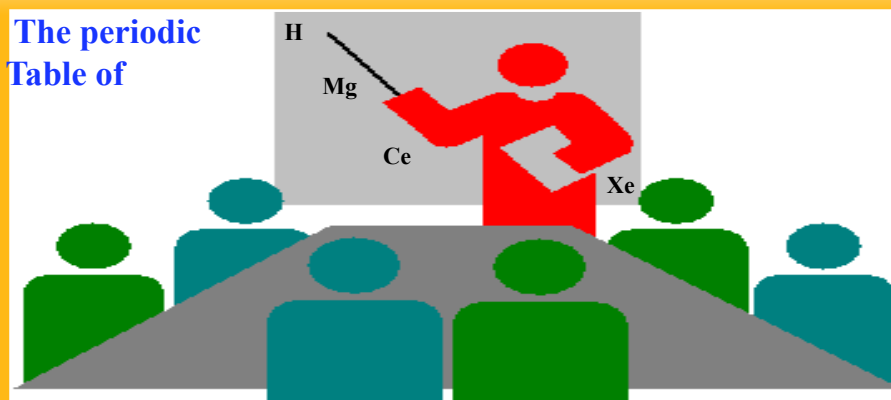
- (4) *Why are rare elements like silver, gold, platinum, helium and neon so well known?*

They are all very unreactive and, therefore, are more obvious to us as they are found uncombined with other elements or are easily produced from their compounds.

- (5) *Look at element 38 - Strontium. Use the internet or books to find as much as you can about this element. In what country was it discovered? After what was it named? Has it any uses?*

Strontium was first discovered in Scotland. It was found in an old mine which was digging for compounds of silver and lead. The miners found large quantities of a dull grey-white rock which they called strontianite because the mine was very close to a tiny village called Strontian. The rock was later found to be strontium carbonate and the element was named after the village. Rocks containing strontium are quite common but there are few uses for the metal or its compounds. One use is the production of fireworks because strontium compounds give a very strong red colour to any flame. The next time you see red colours in fireworks, it may well be produced by small quantities of strontium compounds. It is also used to produce glass for colour television tubes, to refine zinc and to make optical materials. You may have found other uses.

## The Periodic Table of Elements



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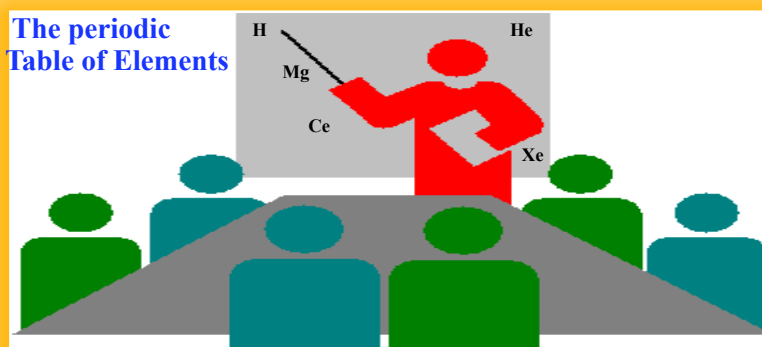
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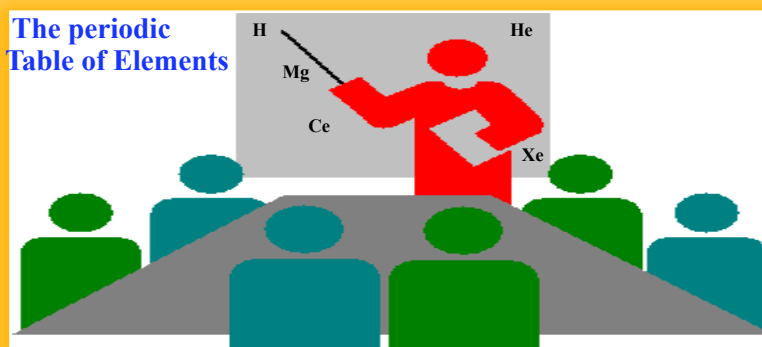
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Let's now look at some simple patterns in the periodic table.



## When were the Elements Discovered ?

Look at the periodic table below. This shows the dates of discovery (the dates when the elements were obtained in a reasonably pure form (some were known to exist before that) for many of the elements:

Dates of Discovery of the Elements																	
<sup>1</sup> H 1776																	<sup>2</sup> He 1895
<sup>3</sup> Li 1817	<sup>4</sup> Be 1828											<sup>5</sup> B 1808	<sup>6</sup> C 1772	<sup>7</sup> N 1776	<sup>8</sup> O 1886	<sup>9</sup> F 1886	<sup>10</sup> Ne 1898
<sup>11</sup> Na 1807	<sup>12</sup> Mg 1808											<sup>13</sup> Al 1827	<sup>14</sup> Si 1824	<sup>15</sup> P 1669	<sup>16</sup> S 1774	<sup>17</sup> Cl 1894	<sup>18</sup> Ar 1894
<sup>19</sup> K 1807	<sup>20</sup> Ca 1808	<sup>21</sup> Sr 1876	<sup>22</sup> Ti 1791	<sup>23</sup> V 1801	<sup>24</sup> Cr 1797	<sup>25</sup> Mn 1774	<sup>26</sup> Fe 1735	<sup>27</sup> Co 1751	<sup>28</sup> Ni 1751	<sup>29</sup> Cu 1746	<sup>30</sup> Zn 1875	<sup>31</sup> Ga 1886	<sup>32</sup> Ge 1649	<sup>33</sup> As 1817	<sup>34</sup> Se 1826	<sup>35</sup> Br 1898	<sup>36</sup> Kr 1898
<sup>37</sup> Rb 1861	<sup>38</sup> Sr 1808	<sup>39</sup> Y 1828	<sup>40</sup> Zr 1801	<sup>41</sup> Nb 1782	<sup>42</sup> Mo 1937	<sup>43</sup> Te 1844	<sup>44</sup> Ru 1803	<sup>45</sup> Rh 1803	<sup>46</sup> Pd 1817	<sup>47</sup> Ag 1863	<sup>48</sup> Cd 1620	<sup>49</sup> In 1782	<sup>50</sup> Sn 1811	<sup>51</sup> Sb 1898	<sup>52</sup> Te 1940	<sup>53</sup> I 1900	<sup>54</sup> Xe 1900
<sup>55</sup> Cs 1860	<sup>56</sup> Ba 1808	<sup>57</sup> La 1839	<sup>72</sup> Hf 1923	<sup>73</sup> Ta 1783	<sup>74</sup> W 1925	<sup>75</sup> Re 1803	<sup>76</sup> Os 1803	<sup>77</sup> Ir 1735	<sup>78</sup> Pt 1735	<sup>79</sup> Au 1861	<sup>80</sup> Hg 1753	<sup>81</sup> Tl 1898	<sup>82</sup> Pb 1898	<sup>83</sup> Bi 1940	<sup>84</sup> Po 1900	<sup>85</sup> At 1900	<sup>86</sup> Rn 1900
<sup>87</sup> Fr 1939	<sup>88</sup> Ra 1898	<sup>89</sup> Ac 1889															



*For you to talk  
about .....*

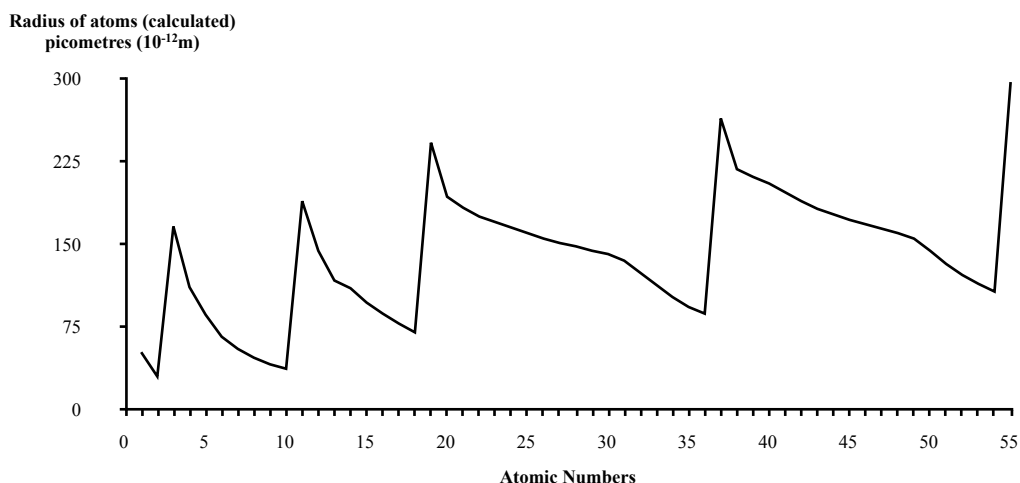
- The dates of discovery for some elements are **not** given. Can you suggest a reason why they are not shown?  
.....
- Look at the last column (the noble gases). Where do most of these gases occur in the world?  
Why do you think they were they all discovered at a similar time?  
.....
- Many of the metals in columns I and II were discovered near the start of the 19th century. These are common metals. Why were they discovered so late in the world's history? What allowed them to be discovered at this time?  
.....
- Why were metals like copper, silver, gold, tin and lead discovered so early?  
.....
- Nitrogen, oxygen and chlorine were all discovered about the same time.  
Can you suggest a reason why? Why was fluorine discovered later?  
.....

## What Sizes are the Atoms of the Elements?

Look around your class. We are all different shapes and sizes. Yet we are all human beings! What about the different kinds of atoms? What are their shapes and sizes? Let us look at their sizes for the moment. We are going to assume they look like spheres - incredibly tiny.

We might expect the atoms simply to become larger as we move through the elements. However, it is not quite as simple as that. Here is a graph showing how the size of atoms changes as we increase the atomic number.

We have imagined that all the atoms are like tiny spheres. We can show their sizes by considering the radius of the sphere. Here, the radius of each element (from 1 to 56) is plotted against the atomic number. The radii are shown in picometres. There are a million, million picometres in one metre. Atoms are incredibly small!!



*For you to talk  
about .....*

- (6) Look at the graph. List the elements which come at the 'peaks'.
- .....
- (7) Look at the graph. List the elements which come at the 'troughs'.
- .....
- (8) Why do the **metals** which have a larger atomic radius tend to be more reactive than the metals which have a smaller radius?
- .....
- .....
- .....

## How Did you Get on ?

- (1) *The dates of discovery for some elements are not given. Can you suggest a reason why they are not shown ?*

The date of discovery for some elements such as iron, carbon, silver and gold are not given because they were discovered in prehistory and have been known since ancient times.

- (2) *Look at the last column (the noble gases). Where do most of these gases occur in the world? Why do you think they were all discovered at a similar time?*

Did you think of any good reasons? It took time for chemists to develop ways to handle gases. Once they knew this, research on gases was possible. For a long time, air was thought to be entirely nitrogen and oxygen. It was not until they did accurate measurements on the density of gases in the air that they realised that air must contain other gases. William Ramsay then started to look for these gases and he found five of them one after the other.

- (3) *Many of the metals in columns I and II were discovered near the start of the 19th century. These are common metals. Why were they discovered so late in the world's history? What allowed them to be discovered at this time?*

They were discovered so late because of their reactivity. They are always found linked strongly with one or more other elements. They do not occur in nature on their own. The only way to obtain these metals is by means of electrical energy (electrolysis). This could not happen until electricity was discovered and developed enough to be used. Amazingly, electricity was only used for experiments at the start of the nineteenth century and it took nearly 100 years before it was developed enough to use in homes.

- (4) *Why were metals like copper, silver, gold, tin and lead discovered so early?*

They are rare elements and they are very unreactive. Despite their rarity, they could be obtained easily from their compounds (they do not form strong bonds with other elements).

- (5) *Nitrogen, oxygen and chlorine were all discovered about the same time. Can you suggest a reason why? Why was fluorine discovered later?*

Scientists found it difficult to do experiments with gases. They had to learn ways to handle gases: how to keep them in containers, how to move them from one container to another, how to store, how to stop them being mixed up with air and so. Once this was achieved, the elements which are gases could be studied.

Think about fluorine? Have you ever seen any? It is so reactive that it reacts with most metals (often violently) and even with glass and water. It is so reactive that it can only be obtained by electrolysis, with no water present at all. It took a long time to overcome these problems. In passing, it is extremely dangerous because it reacts with the human body as well and therefore will destroy any experimenter if it escapes!!

- (6) *Look at the graph. List the elements which come at the 'peaks'.*

Lithium, sodium, potassium, rubidium and caesium.

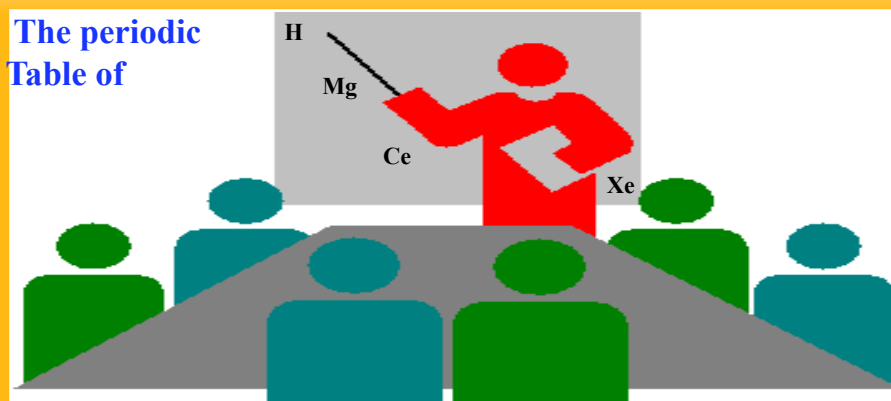
- (7) *Look at the graph. List the elements which come at the 'troughs'.*

Fluorine, chlorine, bromine and iodine.

- (8) *Why do the which have a larger atomic radius tend to be more reactive than the metals which have a smaller radius?*

Metals react by losing one or more electrons to non-metal atoms. Metal atoms tend to be quite large (compared to non-metal atoms). The larger the atom, the less well the electron will be held. It takes energy to remove an electron from isolated metal atoms (look at the ionisation energies) but, with large atoms, the amount of energy is less and therefore, they will react more easily.

## The Periodic Table of Elements



### How to Use this Booklet

- 👤 Read the booklet carefully.
- 👤 Stop at the questions and *discuss* possible answers with other members of your group.
- 👤 Write down your *agreed* answers.
- 👤 You may need to look up books or search the world-wide web using a computer.
- 👤 You can keep this set of sheets.
- 👤 Your work will NOT be marked by anyone.
- 👤 Possible answers to the questions will be provided at the end.
- 👤 Only use these ***after*** you have tried your best to find the answers.

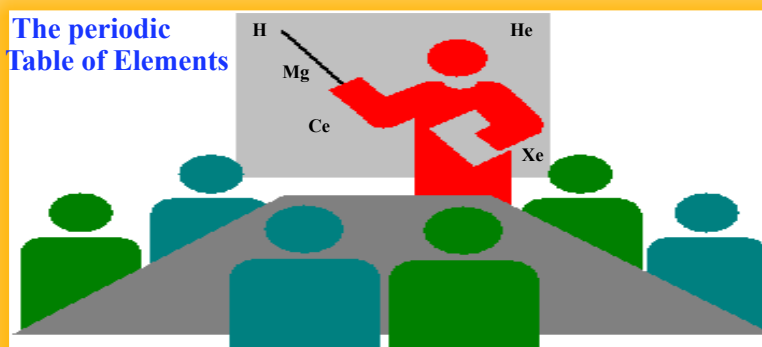
### ***Working in Groups***

*This booklet is designed to help you understand the periodic table of the elements.*

*It is designed so that you can work in a small group.*

*Discuss the possible answers to the questions.*

*Then, write in your agreed answers.*



### How did it all Start ?

The first suggestion that all matter was made up of very small particles was made by the Greek philosopher, Democritus, in 440BC. He asked the question, “*if I cut this object in half and then each bit in half, can I go on forever?*” He suggested that there would come a time when he would be down to the fundamental particles. They would be ‘uncuttable’. The Greek word for ‘uncuttable’ is ‘atomos’. This gave us our word ‘atom’.

Centuries later, the English scientist John Dalton took the very careful measurements made in the late 18<sup>th</sup> century by the French chemist Antoine Lavoisier and deduced that all matter was made up of atoms in specific and fixed proportions. He started to use the word ‘atom’.

By the early nineteenth century, the idea that there was a number of different atoms was well accepted. These were known as the elements. It was known that atoms of some elements were heavier than the atoms of others. Jons Jacob Berzelius, in Sweden, then showed that it was possible to compare the weights of atoms of different elements and compare them to the weight of a hydrogen atom.

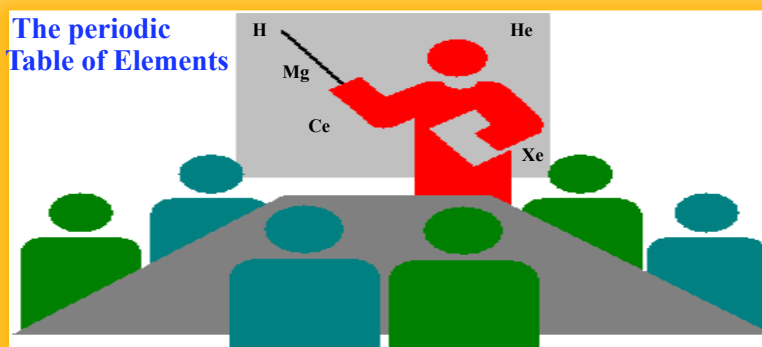
These relative weights became known as atomic weights. Today we use the phrase atomic mass and to show that we are simply comparing the masses, we use the phrase, ‘*relative atomic mass*’. People now started to look for patterns in the elements.

In 1829, Wolfgang Dobereiner, of Germany, noticed that, in some groups of three chemically similar elements (for example, Cl, Br, I; Ca, Sr, Ba; S, Se, Te), the relative atomic mass of the middle element is nearly midway between those of the first and last. The way the middle element behaved also seem to be ‘*half way*’ between the outer two. These ‘*triads*’ (groups of three) were probably the first attempt at looking for patterns among the elements.

In order to try to sort things out, Friedrich Kekule organised the First International Chemical Congress in Germany in 1860. This was the first ever international gathering of scientists. The most important lecture was given by an Italian, Stanislao Cannizzaro, who persuaded his listeners of the importance of accurate values of atomic masses.

In the next few years, several chemists began to list the known elements in the order of their relative atomic masses. A few of them noticed that, certainly to begin with, every eighth element had similar properties. The great breakthrough came in 1869. The Russian chemist, Dmitri Mendeleev (followed by the German, Julius Lothar Meyer, the following year), suggested that placing all the known elements in order of their relative atomic masses led to behaviour patterns repeating themselves.

This is the idea of periodicity and was presented by Mendeleev as a periodic table of the elements. The word ‘periodic’ was used because he found that there was a repeat pattern after 8 elements.



### Is the Periodic Table Useful?

When Mendele'ev first proposed his periodic arrangement of elements by their atomic masses, he had no idea why the different elements had different atomic masses. Neither could he explain the behaviour of the elements.

At the beginning of the twentieth century, scientists discovered the structure of the atoms and showed that the atomic *number* of an element is more important than the relative atomic mass of the element. The atomic number is the number of protons in one atom of each element.

Thus, today, the Periodic Table is arranged so that it tells not only the properties of the elements but also about the number of protons in their atoms. In addition, we now understand why elements are arranged in the patterns of the periodic table, because we have a clear understanding of the structure of individual atoms, and how the arrangement of the electrons in different energy levels affects the reactivity of the elements.

#### Do you Know that ?

Element 101 was named Mendelevium (Md),  
Asteroid 2769 was named after Mendele'ev.  
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One way to make our life easier is to put things with similar behaviour into groups. For example, in supermarkets, the milk products are grouped together in the same place while the cleaning products are grouped together in a different place. The usefulness of this classification is to help customers find the kind of products they want easily.

There are over 100 elements. Can you remember the behaviour of all of these elements? That's more or less an impossibility!! The Periodic Table sorts the elements into families (they are called **groups**) and each group lies in a column. However, there are many patterns and trends which are found to exist in both the groups and also in the rows of the elements. Today, we can often understand why these patterns exist. However, the periodic table was first formed simply by placing the elements in order of the atomic mass of the elements by Mendele'ev. Today's periodic table has the elements in order of atomic number (which gives almost the same order as that obtained using atomic mass).

Let's now look at some simple patterns in the periodic table.

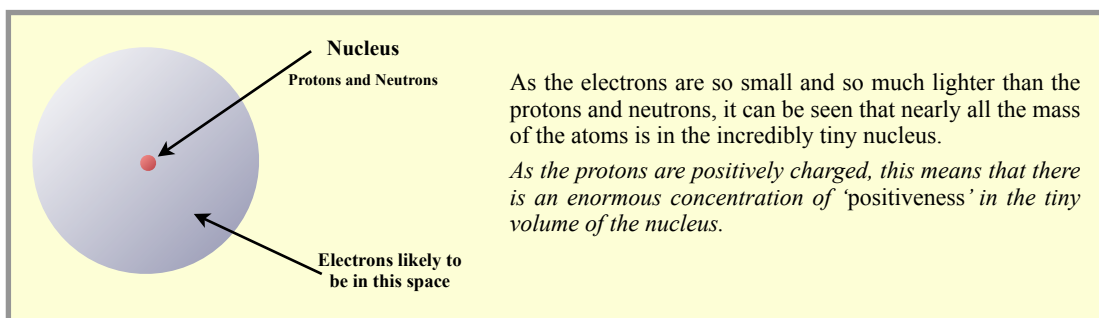
## Looking Inside Atoms

You will remember that atoms are made up of protons, neutrons and electrons:

It is now known that three particles are involved in all atoms:

The proton	positively charged, with a mass of 1 unit
The electron	negatively-charged, with a mass of 1/1850 of a unit
The neutron	no charge, with a mass of 1 unit

There is very strong evidence that shows that the protons and neutrons occupy a very tiny space in the heart of the atom and we call this the nucleus. The electrons are spread out in a very much larger volume around the nucleus. They do NOT move in circles. Here is a picture of what is known today:



We are now going to discuss how these electrons might behave. As they are spread out in a volume of space around the nucleus, their behaviour controls how the atoms behave as they come into contact with other atoms.

We are going to look at how easy it is to knock an electron out of an atom. An electron carries a negative electrical charge. If an atom loses an electron, then it becomes positive, as there is now one more proton than the electrons.

We can consider one atom on its own:



Can you see the problem is this? Atoms are incredibly small. We need to take lots and lots of atoms and then see how much energy it takes to knock one electron out of each of the atoms.

Let us now look at the way atoms hold on to their electrons. Let us take a large number of atoms - in fact we shall take a mole of atoms (approximately 600,000,000,000,000,000,000 atoms !!).

### The Mysterious Mole!!

The mole is a quite enormous number.

**It has the value:  $6 \times 10^{23}$**

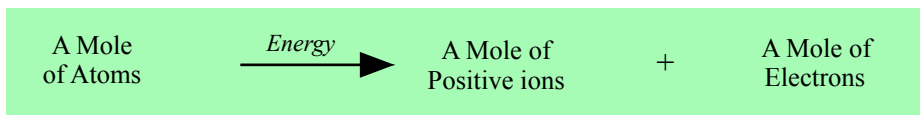
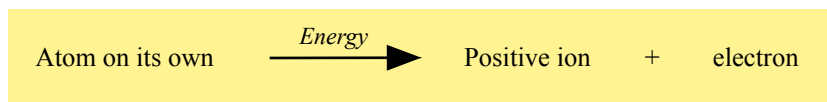
To see just large it is, think of the population of the world.

It would take roughly 100 000 000 000 000 'worlds' like our own to hold a mole of people!

Yet, in 4 small spoonfuls of water, there is about a mole of molecules of water. If you pour sugar onto your hand until your palm is full, there will be about a mole of sugar molecules on your hand.

The sizes of molecules (and atoms as well) are incredibly small!!

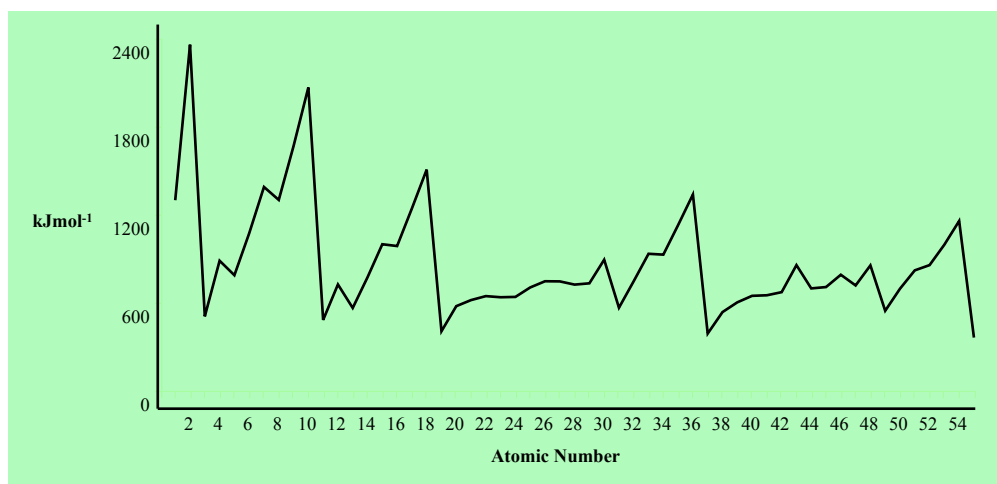
If we want to remove an electron from each atom in this number, we need to *use* energy. This is known as the *ionisation energy*.



We can write this as an equation:



The graph below shows how much energy is needed to remove one electron from each atom of a mole of atoms. It has a strange shape!



*For you to talk  
about .....*

- (1) Look at the graph. List the elements which come at the 'peaks'.

.....

- (2) Look at the graph. List the elements which come at the 'troughs'.

.....

It is also possible to use *more* energy and remove a second electron from each atom on its own. The energy required is known as the *second* ionisation energy:



- (3) Do you think the second ionisation will always be larger than the first ionisation? Explain your thoughts.

.....



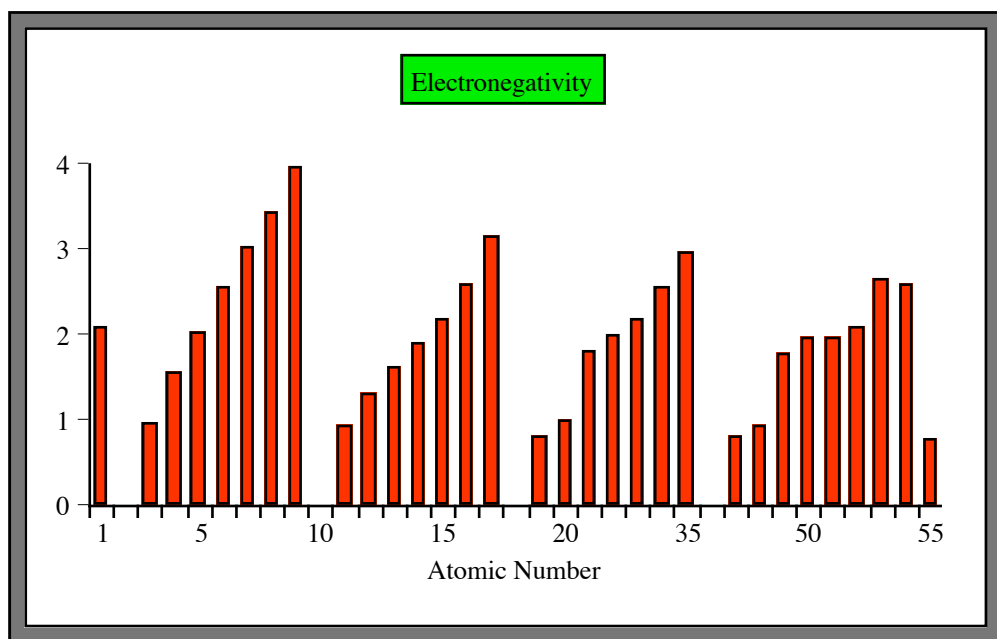
## Electrons and Atoms

It is possible to look at the energy involved in removing electrons from atoms and to look at the energy involved when electrons are added to atoms. This has given rise to what are called **electronegativity numbers**. This indicates the tendency for atoms to *gain or lose* electrons.

Again, we can plot the electronegativity value against atomic number to see the trends for the elements. The actual electronegativity value has no meaning but we can compare atoms to each other. Thus, for example, if two elements (eg. carbon and hydrogen) have atoms with approximately the same electronegativity, then we can say that the two atoms tend to hold electrons equally tightly.

A high electronegativity means that the atom holds electrons very tightly. A lower value means that the atom holds electrons less tightly. **Remember that no atom of any element ever ‘wants’ to lose an electron.**

It is not possible to measure values for the noble gases and they are omitted.



***For you to talk  
about .....***

- (4) Look at the graph and name the group of elements which have the lowest electronegativities?  
Can you suggest a reason why?

.....

- (5) Look at the graph and name the elements which have the highest electronegativities?  
Can you suggest a reason why?

.....

### How Did you Get on ?

- (1) *Look at the graph. List the elements which come at the 'peaks'.*

Helium, neon, argon, krypton and xenon.

- (2) *Look at the graph. List the elements which come at the 'troughs'.*

Lithium, sodium, potassium, rubidium and caesium.

- (3) *Why do you think the second ionisation is always larger than the first ionisation?*

The second ionisation energy is the energy required to remove the second electron from the positive ion after the first electron has already been removed from atom. Because the atom is already positive, it will be even more difficult to remove a negative electron from it.

- (4) *Look at the graph and name the group of elements which have the lowest electronegativities? Can you explain why?*

The alkali metals have the lowest electronegativities. This is simply because the atoms are larger and the outer electron is quite a distance from the nucleus and is, therefore, held less tightly.

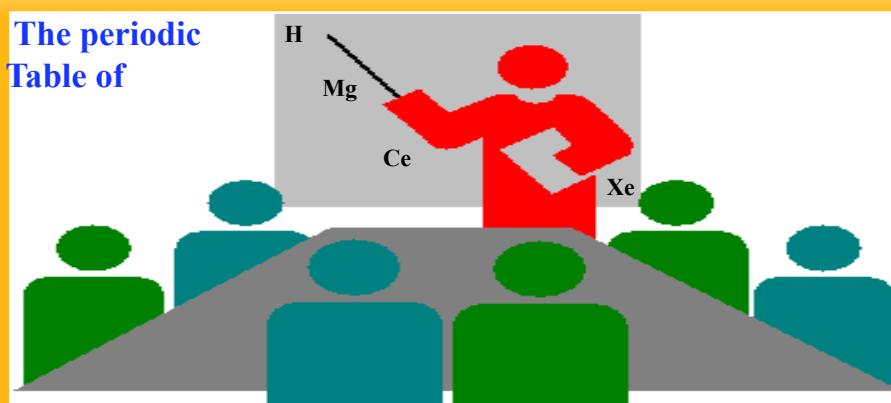
- (5) *Look at the graph and name the elements which have the highest electronegativities . Can you explain why?*

Fluorine, chlorine, bromine and iodine have the highest electronegativities.

These atoms are smaller and the outer electrons are, therefore, closer to the nucleus. They are held all the more tightly by the nucleus and much energy is needed to pull them away.

Unit 11+12

The Periodic Table of Elements



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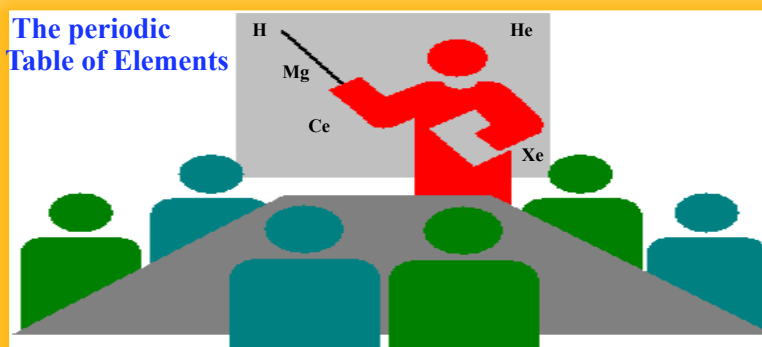
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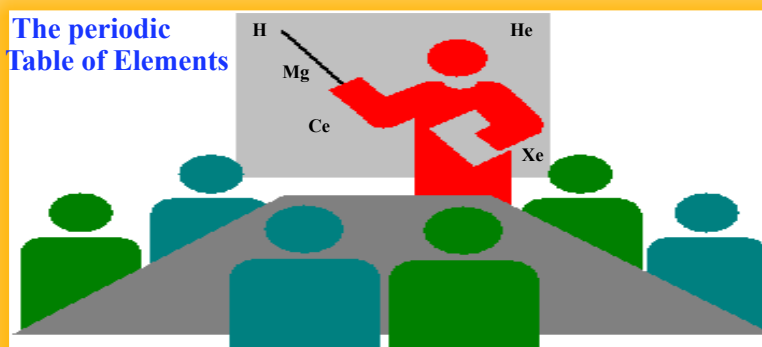
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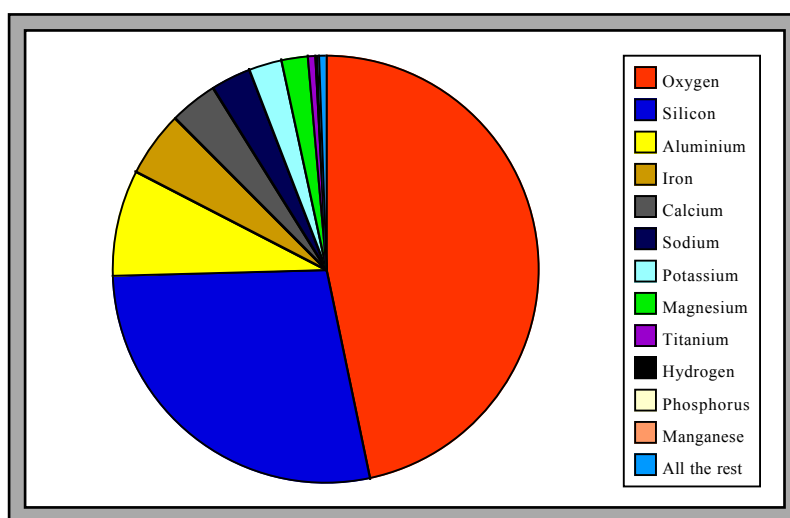
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Let's now look at some simple patterns in the periodic table.

## How Common are the Elements ?

Amazingly, most of the earth's crust (the air, the sea and water, the rocks to a depth of about 5 miles) is made up of only 12 of the elements:



The Periodic Table shows most of the elements, with colours to show how common they are.

1H																	2He				
3Li	4Be															5B	6C	7N	8O	9F	10Ne
11Na	12Mg															13Al	14Si	15P	16S	17Cl	18Ar
19K	20Ca	21Sr	22Ti	23V	24Cr	25Mn	26Fe	27Co	28Ni	29Cu	30Zn	31Ga	32Ge	33As	34Se	35Br	36Kr				
37Rb	38Sr	39Y	40Zr	41Nb	42Mo	43Te	44Ru	45Rh	46Pd	47Ag	48Cd	49In	50Sn	51Sb	52Te	53I	54Xe				
55Cs	56Ba	57La	72Hf	73Ta	74W	75Re	76Os	77Ir	78Pt	79Au	80Hg	81Tl	82Pb	83Bi	84Po	85At	86Rn				
87Fr	88Ra	89Ac																			
			Colour		Element																

Colour	Element
	Oxygen and silicon: about 75% of the Earth's crust
	The next 10 - the really common elements
	Quite common
	Well known elements
	Not so common
	Rare enough to be highly valuable
	The rare elements
	The extremely rare elements



*For you to talk  
about .....*

- (1) Almost 75% of the Earth's crust is made up of the elements **oxygen** and **silicon**.  
Where (air, sea, water and/or rocks?) might you find these elements in the earth's crust?

*Oxygen is in found*

*in:* .....

*Silicon is in found*

*in:* .....

- (2) Look at the elements shaded dark green. After oxygen and silicon, these are the top ten most common elements.  
Are there any surprises and can you explain why they are there?

*Surprises:* .....

*Reasons:* .....

- (3) Many of the elements in columns I and II are common.  
Where would you find these elements (air, sea, water or rocks?) ?

.....

- (4) Why are **rare** elements like silver, gold, platinum, helium and neon so well known?

.....

.....

- (5) Look at element 38 - Strontium.  
Use the internet or books to find as much as you can about this element.  
In what country was it discovered? After what was it named? Has it any uses?

.....

.....

.....

## When were the Elements Discovered ?

Look at the periodic table below. This shows the dates of discovery (the dates when the elements were obtained in a reasonably pure form (some were known to exist before that) for many of the elements:

Dates of Discovery of the Elements																	
<sup>1</sup> H 1776																	<sup>2</sup> He 1895
<sup>3</sup> Li 1817	<sup>4</sup> Be 1828											<sup>5</sup> B 1808	<sup>6</sup> C 1772	<sup>7</sup> N 1776	<sup>8</sup> O 1886	<sup>9</sup> F 1886	<sup>10</sup> Ne 1898
<sup>11</sup> Na 1807	<sup>12</sup> Mg 1808											<sup>13</sup> Al 1827	<sup>14</sup> Si 1824	<sup>15</sup> P 1669	<sup>16</sup> S 1774	<sup>17</sup> Cl 1894	<sup>18</sup> Ar 1894
<sup>19</sup> K 1807	<sup>20</sup> Ca 1808	<sup>21</sup> Sr 1876	<sup>22</sup> Ti 1791	<sup>23</sup> V 1801	<sup>24</sup> Cr 1797	<sup>25</sup> Mn 1774	<sup>26</sup> Fe 1735	<sup>27</sup> Co 1751	<sup>28</sup> Ni 1751	<sup>29</sup> Cu 1746	<sup>30</sup> Zn 1875	<sup>31</sup> Ga 1886	<sup>32</sup> Ge 1649	<sup>33</sup> As 1817	<sup>34</sup> Se 1826	<sup>35</sup> Br 1898	<sup>36</sup> Kr 1898
<sup>37</sup> Rb 1861	<sup>38</sup> Sr 1808	<sup>39</sup> Y 1828	<sup>40</sup> Zr 1801	<sup>41</sup> Nb 1782	<sup>42</sup> Mo 1937	<sup>43</sup> Te 1844	<sup>44</sup> Ru 1803	<sup>45</sup> Rh 1803	<sup>46</sup> Pd 1817	<sup>47</sup> Ag 1863	<sup>48</sup> Cd 1620	<sup>49</sup> In 1782	<sup>50</sup> Sn 1811	<sup>51</sup> Sb 1898	<sup>52</sup> Te 1940	<sup>53</sup> I 1900	<sup>54</sup> Xe 1900
<sup>55</sup> Cs 1860	<sup>56</sup> Ba 1808	<sup>57</sup> La 1839	<sup>72</sup> Hf 1923	<sup>73</sup> Ta 1903	<sup>74</sup> W 1783	<sup>75</sup> Re 1803	<sup>76</sup> Os 1803	<sup>77</sup> Ir 1735	<sup>78</sup> Pt 1735	<sup>79</sup> Au 1861	<sup>80</sup> Hg 1753	<sup>81</sup> Tl 1898	<sup>82</sup> Pb 1898	<sup>83</sup> Bi 1898	<sup>84</sup> Po 1940	<sup>85</sup> At 1900	<sup>86</sup> Rn 1900
<sup>87</sup> Fr 1939	<sup>88</sup> Ra 1898	<sup>89</sup> Ac 1889															



*For you to talk  
about .....*

- (6) The dates of discovery for some elements are **not** given. Can you suggest a reason why they are not shown?

.....

- (7) Look at the last column (the noble gases). Where do most of these gases occur in the world?  
Why do you think they were they all discovered at a similar time?

.....

- (8) Many of the metals in columns I and II were discovered near the start of the 19th century. These are common metals. Why were they discovered so late in the world's history? What allowed them to be discovered at this time?

.....

- (9) Why were metals like copper, silver, gold, tin and lead discovered so early?

.....

- (10) Nitrogen, oxygen and chlorine were all discovered about the same time.  
Can you suggest a reason why? Why was fluorine discovered later?

.....

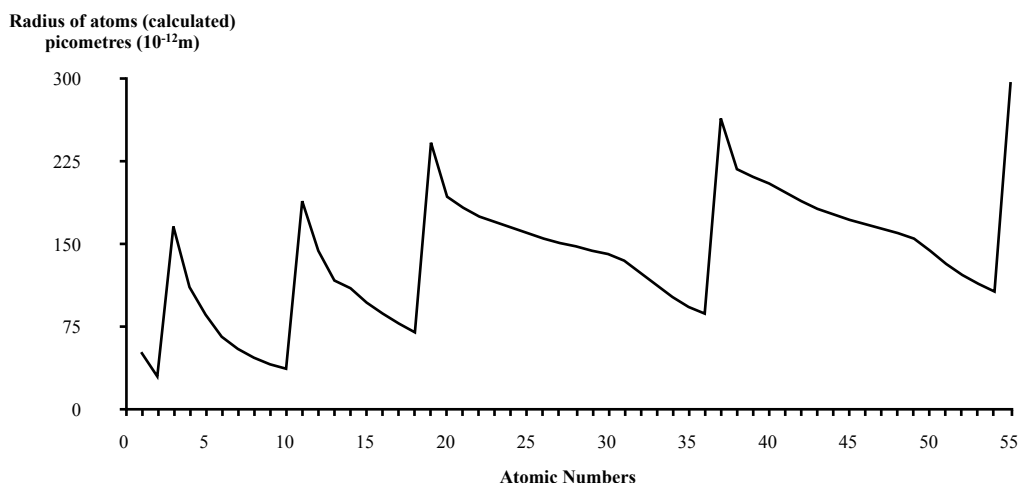


## What Sizes are the Atoms of the Elements?

Look around your class. We are all different shapes and sizes. Yet we are all human beings! What about the different kinds of atoms? What are their shapes and sizes? Let us look at their sizes for the moment. We are going to assume they look like spheres - incredibly tiny.

We might expect the atoms simply to become larger as we move through the elements. However, it is not quite as simple as that. Here is a graph showing how the size of atoms changes as we increase the atomic number.

We have imagined that all the atoms are like tiny spheres. We can show their sizes by considering the radius of the sphere. Here, the radius of each element (from 1 to 56) is plotted against the atomic number. The radii are shown in picometres. There are a million, million picometres in one metre. Atoms are incredibly small!!



*For you to talk  
about .....*

- (11) Look at the graph. List the elements which come at the 'peaks'.

.....

- (12) Look at the graph. List the elements which come at the 'troughs'.

.....

- (13) Why do the **metals** which have a larger atomic radius tend to be more reactive than the metals which have a smaller radius?

.....  
.....  
.....

### Surprise !!

*You might have expected that the atomic radius would simply increase with atomic number. This is NOT true. The size of the atoms (as shown by the atomic radius) varies considerably and is not related to the atomic number in a simple way.*

### How Did you Get on ?

- (1) *Almost 75% of the Earth's crust is made up of the elements oxygen and silicon. Where (air, sea, water or rocks?) might you find these elements in the earth's crust?*

Oxygen is found in the air, and in water (including, of course, the sea). It is also found in most rocks (the most common rocks are silicates). Silicon occurs in silicate rocks and also as silicon dioxide (sand is silicon dioxide and some other rocks also are mainly silicon dioxide eg. quartz, agates).

- (2) *Look at the elements shaded dark green. After oxygen and silicon, these are the top ten most common elements. Are there any surprises and can you explain why they are there?*

Perhaps the most surprising one is titanium. This is extremely common, occurring as the dioxide ( $\text{TiO}_2$ ). Titanium oxide, when pure, is the whitest substance known and is used in all brilliant white paint. It is very difficult to convert the titanium dioxide to titanium metal as this takes an enormous amount of energy. Therefore, titanium metal is quite rare. However, it is incredibly useful, being as strong as steel, with half the density of steel. It also does not rust and it can be dyed to give colour effects. It is used in expensive parts in aircraft, in Olympic bicycles and in making very attractive jewellery. It is also used in making spectacles.

- (3) *Many of the elements in columns I and II are common. Where would you find these elements (air, sea, water or rocks?)*

Most of the metals are found combined with other elements in rocks and in the sea. Lithium, sodium, potassium, rubidium and caesium are mainly in the sea, while strontium and barium are mainly in rocks. Magnesium and calcium occur in both the sea and in rocks. Beryllium is rare and occurs in rocks. Have you ever thought why these metals are found mainly in the sea? Elements are only found in the sea if their compounds are soluble in water and can be washed off the land. Column 1 metal compounds tend to be very water soluble so are found mainly in the sea.

- (4) *Why are rare elements like silver, gold, platinum, helium and neon so well known?*

They are all very unreactive and, therefore, are more obvious to us as they are found uncombined with other elements or are easily produced from their compounds.

- (5) *Look at element 38 - Strontium. Use the internet or books to find as much as you can about this element. In what country was it discovered? After what was it named? Has it any uses?*

Strontium was first discovered in Scotland. It was found in an old mine which was digging for compounds of silver and lead. The miners found large quantities of a dull grey-white rock which they called strontianite because the mine was very close to a tiny village called Strontian. The rock was later found to be strontium carbonate and the element was named after the village. Rocks containing strontium are quite common but there are few uses for the metal or its compounds. One use is the production of fireworks because strontium compounds give a very strong red colour to any flame. The next time you see red colours in fireworks, it may well be produced by small quantities of strontium compounds. It is also used to produce glass for colour television tubes, to refine zinc and to make optical materials. You may have found other uses.

- (6) *The dates of discovery for some elements are not given. Can you suggest a reason why they are not shown?*

The date of discovery for some elements such as iron, carbon, silver and gold are not given because they were discovered in prehistory and have been known since ancient times.

- (7) *Look at the last column (the noble gases). Where do most of these gases occur in the world? Why do you think they were they all discovered at a similar time?*

Did you think of any good reasons? It took time for chemists to develop ways to handle gases. Once they knew this, research on gases was possible. For a long time, air was thought to be entirely nitrogen and oxygen. It was not until they did accurate measurements on the density of gases in the air that they realised that air must contain other gases. William Ramsay then started to look for these gases and he found five of them one after the other.

- (8) *Many of the metals in columns I and II were discovered near the start of the 19th century. These are common metals. Why were they discovered so late in the world's history? What allowed them to be discovered at this time?*

They were discovered so late because of their reactivity. They are always found linked strongly with one or more other elements. They do not occur in nature on their own. The only way to obtain these metals is by means of electrical energy (electrolysis). This could not happen until electricity was discovered and developed enough to be used. Amazingly, electricity was only used for experiments at the start of the nineteenth century and it took nearly 100 years before it was developed enough to use in homes.

- (9) *Why were metals like copper, silver, gold, tin and lead discovered so early?*

They are rare elements and they are very unreactive. Despite their rarity, they could be obtained easily from their compounds (they do not form strong bonds with other elements).

- (10) *Nitrogen, oxygen and chlorine were all discovered about the same time. Can you suggest a reason why? Why was fluorine discovered later?*

Scientists found it difficult to do experiments with gases. They had to learn ways to handle gases: how to keep them in containers, how to move them from one container to another, how to store, how to stop them being mixed up with air and so. Once this was achieved, the elements which are gases could be studied.

Think about fluorine? Have you ever seen any? It is so reactive that it reacts with most metals (often violently) and even with glass and water. It is so reactive that it can only be obtained by electrolysis, with no water present at all. It took a long time to overcome these problems. In passing, it is extremely dangerous because it reacts with the human body as well and therefore will destroy any experimenter if it escapes!!

- (11) *Look at the graph. List the elements which come at the 'peaks'.*

Lithium, sodium, potassium, rubidium and caesium.

- (12) *Look at the graph. List the elements which come at the 'troughs'.*

Fluorine, chlorine, bromine and iodine.





- (13) *Why do the which have a larger atomic radius tend to be more reactive than the metals which have a smaller radius?*

Metals react by losing one or more electrons to non-metal atoms. Metal atoms tend to be quite large (compared to non-metal atoms). The larger the atom, the less well the electron will be held. It takes energy to remove an electron from isolated metal atoms (look at the ionisation energies) but, with large atoms, the amount of energy is less and therefore, they will react more easily.

**Teacher's Guide**  
**Group Work Units**  
**Chemistry**

**Background**

This set of ten units were designed some years ago for use with school school students studying chemistry. They are offered here with some general aims in mind. They provide a structured discussion for senior school school students in chemistry to collaborate with each other in:

-  Carrying out chemistry calculations and thinking;
-  Seeing something of how chemistry developed;
-  Seeing chemistry being applied in wider life;
-  Discussing and arguing where there are no easy, clear-cut answers.

Most work in most occupations in life involve collaboration, with people working in teams or groups. These discussion tasks offer an opportunity for the school students to experience such collaborative work. This is a useful life skill to develop. At the same time, previous work shows that these materials teach chemistry very efficiently and effectively.

**Warning**

The aim of the units is not to fill the heads of the school students with more chemical facts. Therefore, allow your school students the freedom to talk, think, argue, discuss, even when they come up with answers that are incomplete. Do not be tempted to 'teach' the class the 'right' answers. That will destroy the power of the units to educate!!

**Your Role**

Your role will change. No longer will the learning be centred on you and your knowledge of chemistry. You will become a manager of learning. You will have to stand back and allow the school students to engage with the materials, only intervening if a group gets completely lost. Past experience shows that this does not happen too often. The school students need to be allowed the time and opportunity to 'battle' the ideas through on their own.

Past experience has shown that the first unit they attempt is daunting for the approach is unfamiliar to them. The next unit always goes much better. The experience of learning this way is what important. Getting 'right' answers is less important.

For their use, the following procedures should be adopted:

- ☒ Form groups of 3 (preferably) or 4 school students (never larger) and allow them sit in such a way that they can talk easily.
- ☒ Inform the school students that they are trying out some chemistry tasks which should be fun.
- ☒ Inform them that nothing will be marked or assessed.
- ☒ Encourage the school students to work with each other. They should not work on their own.
- ☒ At the end, you may find it useful to hold a brief class discussion and you can offer comments on the work, based on the attached guides which are given for each unit.
- ☒ The timings given are only very approximately and may vary widely with group to group.

## Unit 1 Which is the Best Fuel?

## Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "*Which is the Best Fuel ?*" to each school student. Give one copy of the "*Answer Sheet*" to each group.
- ☒ School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 35 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

## Possible Answers

**Part 1:** The combustion equations are:



**Parts 2 and 3:** The school students are not expected to carry out the rough calculations using the concept of the mole although they may choose to do so. However, the mole is a notoriously difficult concept and need not be invoked. They can quickly estimate the number of formula masses of each in 1000g of each and hence work out the relative number of molecules formed in each equation. This shows that the methane gives the greatest number of product molecules and is, on the assumption given, likely to provide the most energy for each 1000g burned.

The approximate answers that school students may reach are given:

Molecule	Formula Mass	Number of gram formula masses in 1000g	Molecules' formed
Carbon	12	83	$83 \times 1 = 83$
Petrol ( $\text{C}_{11}\text{H}_{24}$ )	156	6.4	$6.4 \times 23 = 147$
Gas ( $\text{CH}_4$ )	16	62.5	$62.5 \times 3 = 188$

To show how this works, consider methane.

- 💡 With a formula mass of 16, there are  $1000 \div 16 [= 62.5]$  formula masses [moles] in 1000g.
- 💡 The equation gives three product molecules.
- 💡 Therefore, there are  $3 \times 62.5 [= 188]$  'equation molecules' [moles of product molecules] formed.
- 💡 Because comparisons only are being made, this is sufficient.
- 💡 The purpose of the exercise is to allow the school students to work with the data to reach an answer and then be able to justify why they think their answer is valid. They do not need exact calculations at all.

**Part 4:** They may see that they are assuming that the formation of  $\text{H}_2\text{O}$  and  $\text{CO}_2$  produces similar energy but they may not be aware of ideas like bond energy. They may not be aware that the overall energy changes depend on bonds *broken* in reactants and bonds *made* in products. However, in discussion, they may be able to begin to share ideas that lead towards these ideas, using their own language. In summary, they may be able to see that, if the various bonds are similar in energy then the energy released is approximately proportional to the number of molecules formed. In fact, the assumption is good enough to show that methane will release most energy.

## Unit 2 The Glowing Splint Problem

### Guidelines

- ✓ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ✓ Give a copy of the unit entitled "The Glowing Splint Problem" to each school student. Give one copy of the "Answer sheet" to each group. School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ✓ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ✓ A suggested time for the unit is about 25 minutes.
- ✓ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

### Possible conclusions and methods

- 🔍 In part 1, school students are being encouraged to think again through what is happening in the combustion of fuels. In a car cylinder, burning fossil fuels at high temperatures provides the conditions for nitrogen and oxygen that are from the air to form nitrogen oxides (nitric oxide initially which then is converted rapidly into nitrogen dioxide).
- 🔍 Nitrogen dioxide gas can combine with water to form nitric acid, which can condense in the exhaust system and cause corrosion. Equally, nitrogen dioxide can emerge into the atmosphere to form acid droplets and to react with other pollutants. The oxide and its products are all harmful to the environment and to humans.
- 🔍 There are two ways to reduce the problem of  $\text{NO}_2$  in a car: transition metal catalysts can convert the nitrogen dioxide back to nitrogen and oxygen or the fuel to air ratio can be improved to lower to formation of oxides of nitrogen. Neither is perfect in that the catalysts work poorly at low temperatures (when a car starts) and the formation of the oxides cannot be eliminated completely by engine adjustment.
- 🔍 In part 2, using the hint of the idea of catalysis, school students are asked to explain what appears to be quite illogical: the nitrogen dioxide oxygen mixture would not be expected to re-kindle the glowing splint by comparison with air.
- 🔍 In fact, a glowing splint catalyses the decompose of  $\text{NO}_2$  to  $\text{N}_2$  and  $\text{O}_2$ . School Students, in their discussion, may come up with other possible explanations eg. carbon is more reactive than nitrogen and is displacing the nitrogen from the dioxide, releasing the oxygen - perfectly reasonable.

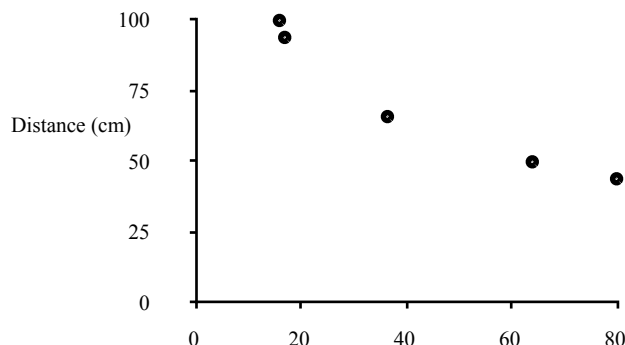
## Unit 3 Moving Gases

### Guidelines

- ✓ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ✓ Give a copy of the unit entitled "Moving Gases" to each school student. Give one copy of the "Answer sheet" to each group. School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ✓ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ✓ A suggested time for the unit is about 25 minutes.
- ✓ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

### Possible conclusions and prediction

- (1) School students may play with several ideas before they begin to spot that the distance travelled is related to molecular mass. They may simply see that the larger the formula mass, the smaller the distance. This is sufficient to make an estimate of the answer. Most will not think of drawing a graph. However, a rough graph is shown:



- (2) Others may go further: if they look at sulphur dioxide and methane, they may see that quadrupling the mass halves the distance travelled. Some may then see the inverse square relationship.
- (3) Whatever they do, they can test their idea by looking at other gases in the table to see if their hypothesis stands up.
- (4) Their answer for chlorine will depend how which method they used. The most accurate answer, from the data given, is 48 cm. Getting the 'right' answer is not so important as seeing how a possible answer may be obtained.

## Unit 4 The Formula for Ozone

### Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "The Ozone Problem" to each school student. Give one copy of the "Answer sheet" to each group. School Students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 30 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

### Possible conclusions and methods

**Part 1** School students will struggle for a little while before they begin to see (or recall) that it is the number of gas molecules that is related to the gas volume: Gas volumes are related to balanced equations. They then test this out in reactions (1) and (2).

- (1) The volume of  $\text{CH}_4$  is 10 ml.
- (2) The volume of  $\text{CO}_2$  is 20 ml.

**Part 2** In accordance with the rule they have established, there must be two molecules of ozone giving three molecules of oxygen:



This gives 6 oxygen atoms on the right, demanding six on the left:  $\text{O}_3$  is the only possible way to achieve this.

## Unit 5 The Phosphorus Problem

### Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "The Phosphorus Problem" to each school student. Give one copy of the "Answer sheet" to each group. School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 25 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

### Possible conclusions and methods

School Students will find it difficult at the start to sort through the amount of data to see what is significant and useful. Looking at melting and boiling points shows clearly that, with very slight cooling, the calcium silicate solidifies leaving the others as gases. In practice, liquid calcium silicate is run out of the bottom of the furnace, the three gases emerging in a pipe from the top.

If the gases are merely cooled to around  $25^\circ\text{C}$ , the phosphorus will solidify, leaving carbon monoxide and silicon tetrafluoride as gases. However, there is no way to get at the phosphorus without letting in air, thus causing a major fire.

The three gases have to be cooled in water. The problem here is that the silicon tetrafluoride reacts to form silicon dioxide which then contaminates the phosphorus.

The trick is to cool in water at a temperature above  $44^\circ\text{C}$  (in fact about  $70^\circ\text{C}$  is used). At this temperature, the phosphorus stays as a liquid and can be separated readily from the solid silicon dioxide. After the silicon dioxide is removed, the water is allowed to cool and the solid phosphorus forms under the water. The carbon monoxide continues on as a gas. The water will, in fact, contain dissolved hydrogen fluoride but this does not contaminate the solid phosphorus.

## Unit 6 Salt, Salts, and pH

## Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "Salt, Salts, and pH" to each school student. Give one copy of the "Answer sheet" to each group. School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 25 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

## Possible Conclusions

Here are some possible ideas they may develop....

- (1) Solutions of salts in water are not always neutral.
- (2) Solutions of salts of transition metals are acidic.
- (3) Solutions of carbonates are basic (pH more than 7).
- (4) Solutions of salts containing group 1 metals such as sodium always have a pH of 7 or more.
- (5) Solutions of salts contains anions such as  $\text{Cl}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$  always have a pH of 7 or less.

## Unit 7 Solubility

## Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "Solubility" to each school student. Give one copy of the "Answer sheet" to each group. School Students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 30-35 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

## Possible conclusions and approaches

- (1) Solubility 'rules' that they might deduce from the data given:
  - Any solid is soluble if it contains sodium, potassium and nitrate ions.
  - Most of the chlorides are soluble (only lead and silver chlorides are insoluble).
  - Some of the sulphates are soluble (calcium, barium, lead and silver sulphates are insoluble).
  - Any solid is insoluble if it contains hydroxide ions and carbonate ions (except for sodium and potassium compounds).
  - Most lead compounds are insoluble except lead nitrate.
- (2) Magnesium hydroxide will be formed.
- (3) Add a solution which contains negative ions such as  $\text{CO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{OH}^-$ ,  $\text{F}^-$ ,  $\text{Cl}^-$  (except  $\text{NO}_3^-$ ) to the mixture solution of lead nitrate and sodium nitrate. The lead ions will combine with these negative ions to form precipitates. Filter the precipitates off, and the rest of the solution is sodium nitrate. Care must be taken not to add excess, thus contaminating the sodium nitrate.
- (4)  $0.16 < \text{Sr}(\text{OH})_2 < 14$  and  $0.0002 < \text{SrSO}_4 < 0.2$   
 In fact, the solubility of strontium hydroxide is 11.7g per 100g, the solubility of strontium sulphate is 0.0006g per 100g.

## Unit 8 Trees and Cars

## Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "Trees and Cars" to each school student. Give one copy of the 'Answer sheet' to each group. School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 35 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

## Possible calculation

There are several ways to tackle the problem. Here is a possible route.

A balanced equation:



From this (or by simply deducing that there are 8 carbons per molecule of octane),

114g of octane will give rise to 352 g of carbon dioxide.

1 litre octane has a mass of 700 g. Thus,

Mass of CO<sub>2</sub> from 1 litre =  $(700 \div 114) \times 352 \text{ g} = 2161 \text{ g}$

The car will use 4200 litres of petrol.

The CO<sub>2</sub> produced will weigh:  $2161 \times 4200 \text{ g} = 9\,076\,000 \text{ g} = 9076 \text{ Kg} [= > 9 \text{ tonnes}]$

Thus, the number of trees required to absorb the CO<sub>2</sub> in a year is over 1500 !!

The newspaper report is completely incorrect.

## Unit 9 Bonding

## Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "Bonding" to each school student. Give one copy of the "Answer sheet" to each group. School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 25 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

## Possible conclusions

The school students have to request information from you. Each item has a charge. They can be trusted to keep their own note of how much they spend.

The information to be given to school students is:

Melting point:	Does not melt, sublimes at 193°C.
Boiling point:	Sublimes.
Solubility in water:	Extremely soluble.
Electrical conductivity as dissolved:	Solution conducts very well.
Electrical conductivity as melt:	Does not melt.
React with water:	Dissolves rapidly, sometimes with a slight "fizz".

The bonding in aluminum chloride is polar covalent, in all phases. The compound tends to exist as a dimeric molecules Al<sub>2</sub>Cl<sub>6</sub>. In water, there is rapid dissolving, sometimes with a reaction giving a slight "fizz" as the aluminium chloride is hydrolysed to give free hydrated aluminum ions and chloride ions. In this phase, the bonding is ionic. Thus, aluminum chloride is a polar molecule but, on reaction with the water, ions are set free.

It is almost impossible for the school student to deduce an answer. This illustrates the way science often works - where easy answers are elusive.



## Unit 10 The Marvels of Growing Hair

## Guidelines

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "The Marvels of Growing Hair" to each school student. Give one copy of the "Answer sheet" to each group. School students will take a few minutes to read the unit before group discussion starts. Have scrap paper available if requested. Each group needs a calculator.
- ☒ Allow enough time for the groups to discuss and agree answers to the questions. Do not take part in the group discussions unless school students get completely confused.
- ☒ A suggested time for the unit is about 30 minutes.
- ☒ You may wish to lead an open class discussion for a few minutes at the end. This time can be used to comment on the problem and to summarise conclusions.

## Possible conclusions and methods

The two students need to work out an estimate for how fast hair grows and how long an amino acid molecule is.

(a) *How fast hair grows?*

If they can imagine the length of a strand of hair when they have their hair cut. Let us suppose that it grows between 1 and 2 cm per month. We need to calculate the length that comes each second.

There are: 30 days x 24 hours x 60 minutes x 60 seconds in a month:  $2.592 \times 10^6$  seconds.

Thus, let us suppose that 1.3 cm grows per month. This is  $1.3 \times 10^{-2}$  metres or  $1.3 \times 10^{+10}$  picometres.

Length growing per second is thus:  $(1.3 \times 10^{+10}) \div (2.592 \times 10^6) \div 0.5 \times 10^4 \text{ picometres} = 5 \times 10^3 \text{ picometres}$ .

(b) *How long is an amino acid molecule?*

There are two bond lengths between the two link points but they are at a slight angle. Assuming they were straight would give 2 x 150 picometres (= 300 picometres). If we make some allowance for the bond angle (the molecule is tetrahedral in shape), let us say that the length is about 250 picometres.

Now we can calculate how many amino acid units link per second.

Number per second =  $5 \times 10^3 \div 250 = 20$

This is quite amazing. This is just one single protein molecule. There are huge numbers of such molecules in the hairs of our head. Yet each one adds about 20 amino acid units every second of our lives.

## Units 11-13 The Periodic Table of Elements

## Guidelines for Use

- ☒ Form the class into groups of 3, with an occasional group of 4 to balance numbers.
- ☒ Give a copy of the unit entitled "*The Periodic Table of Elements*" to each school student.
- ☒ Allow the school students to work their way through the unit, at their own speed.
- ☒ Give access to books and the internet as needed.
- ☒ Do not intervene unless a group is hopelessly lost.
- ☒ The unit is likely to take at least an hour and it may be useful to allow the school students to start it one day and complete it the next, giving them time overnight to conduct the internet searching (which may take time)
- ☒ There is no need for any classroom discussion on this unit unless the school students raise questions.
- ☒ After a group has completed all 18 questions, give out the sheet entitled: *How Did you Get on?* This is given below for your own reference.

Possible Answers (*How Did you Get on?*)

- (1) *Almost 75% of the Earth's crust is made up of the elements oxygen and silicon. Where (air, sea, water or rocks?) might you find these elements in the earth's crust?*

Oxygen is found in the air, and in water (including, of course, the sea). It is also found in most rocks (the most common rocks are silicates). Silicon occurs in silicate rocks and also as silicon dioxide (sand is silicon dioxide and some other rocks also are mainly silicon dioxide eg. quartz, agates).

- (2) *Look at the elements shaded dark green. After oxygen and silicon, these are the top ten most common elements. Are there any surprises and can you explain why they are there?*

Perhaps the most surprising one is titanium. This is extremely common, occurring as the dioxide ( $\text{TiO}_2$ ). Titanium oxide, when pure, is the whitest substance known and is used in all brilliant white paint. It is very difficult to convert the titanium dioxide to titanium metal as this takes an enormous amount of energy. Therefore, titanium metal is quite rare. However, it is incredibly useful, being as strong as steel, with half the density of steel. It also does not rust and it can be dyed to give colour effects. It is used in expensive parts in aircraft, in Olympic bicycles and in making very attractive jewellery. It is also used in making spectacles.

- (3) *Many of the elements in columns I and II are common. Where would you find these elements (air, sea, water or rocks?)*

Most of the metals are found combined with other elements in rocks and in the sea. Lithium, sodium, potassium, rubidium and caesium are mainly in the sea, while strontium and barium are mainly in rocks. Magnesium and calcium occur in both the sea and in rocks. Beryllium is rare and occurs in rocks. Have you ever thought why these metals are found mainly in the

sea? Elements are only found in the sea if their compounds are soluble in water and can be washed off the land. Column 1 metal compounds tend to be very water soluble so are found mainly in the sea.

- (4) *Why are rare elements like silver, gold, platinum, helium and neon so well known?*

They are all very unreactive and, therefore, are more obvious to us as they are found uncombined with other elements or are easily produced from their compounds.

- (5) *Look at element 38 - Strontium. Use the internet or books to find as much as you can about this element. In what country was it discovered? After what was it named? Has it any uses?*

Strontium was first discovered in Scotland. It was found in an old mine which was digging for compounds of silver and lead. The miners found large quantities of a dull grey-white rock which they called strontianite because the mine was very close to a tiny village called Strontian. The rock was later found to be strontium carbonate and the element was named after the village. Rocks containing strontium are quite common but there are few uses for the metal or its compounds. One use is the production of fireworks because strontium compounds give a very strong red colour to any flame. The next time you see red colours in fireworks, it may well be produced by small quantities of strontium compounds. It is also used to produce glass for colour television tubes, to refine zinc and to make optical materials. You may have found other uses.

- (6) *The dates of discovery for some elements are not given. Can you suggest a reason why they are not shown?*

The date of discovery for some elements such as iron, carbon, silver and gold are not given because they were discovered in prehistory and have been known since ancient times.

- (7) *Look at the last column (the noble gases). Where do most of these gases occur in the world? Why do you think they were they all discovered at a similar time?*

Did you think of any good reasons? It took time for chemists to develop ways to handle gases. Once they knew this, research on gases was possible. For a long time, air was thought to be entirely nitrogen and oxygen. It was not until they did accurate measurements on the density of gases in the air that they realised that air must contain other gases. William Ramsay then started to look for these gases and he found five of them one after the other.

- (8) *Many of the metals in columns I and II were discovered near the start of the 19th century. These are common metals. Why were they discovered so late in the world's history? What allowed them to be discovered at this time?*

They were discovered so late because of their reactivity. They are always found linked strongly with one or more other elements. They do not occur in nature on their own. The only way to obtain these metals is by means of electrical energy (electrolysis). This could not happen until electricity was discovered and developed enough to be used. Amazingly, electricity was only used for experiments at the start of the nineteenth century and it took nearly 100 years before it was developed enough to use in homes.

- (9) *Why were metals like copper, silver, gold, tin and lead discovered so early?*

They are rare elements and they are very unreactive. Despite their rarity, they could be obtained easily from their compounds (they do not form strong bonds with other elements).

- (10) *Nitrogen, oxygen and chlorine were all discovered about the same time. Can you suggest a reason why? Why was fluorine discovered later?*

Scientists found it difficult to do experiments with gases. They had to learn ways to handle gases: how to keep them in containers, how to move them from one container to another, how to store, how to stop them being mixed up with air and so. Once this was achieved, the elements which are gases could be studied.

Think about fluorine? Have you ever seen any? It is so reactive that it reacts with most metals (often violently) and even with glass and water. It is so reactive that it can only be obtained by electrolysis, with no water present at all. It took a long time to overcome these problems. In passing, it is extremely dangerous because it reacts with the human body as well and therefore will destroy any experimenter if it escapes!!

- (11) *Look at the graph. List the elements which come at the 'peaks'.*

Lithium, sodium, potassium, rubidium and caesium.

- (12) *Look at the graph. List the elements which come at the 'troughs'.*

Fluorine, chlorine, bromine and iodine.

- (13) *Why do the which have a larger atomic radius tend to be more reactive than the metals which have a smaller radius?*

Metals react by losing one or more electrons to non-metal atoms. Metal atoms tend to be quite large (compared to non-metal atoms). The larger the atom, the less well the electron will be held. It takes energy to remove an electron from isolated metal atoms (look at the ionisation energies) but, with large atoms, the amount of energy is less and therefore, they will react more easily.

- (14) *Look at the graph. List the elements which come at the 'peaks'.*

Helium, neon, argon, krypton and xenon.

- (15) *Look at the graph. List the elements which come at the 'troughs'.*

Lithium, sodium, potassium, rubidium and caesium.

- (16) *Why do you think the second ionisation is always larger than the first ionisation?*

The second ionisation energy is the energy required to remove the second electron from the positive ion after the first electron has already been removed from atom. Because the atom is already positive, it will be even more difficult to remove a negative electron from it.

- (17) *Look at the graph and name the group of elements which have the lowest electronegativities? Can you explain why?*

The alkali metals have the lowest electronegativities. This is simply because the atoms are larger and the outer electron is quite a distance from the nucleus and is, therefore, held less tightly.

- (18) *Look at the graph and name the elements which have the highest electronegativities. Can you explain why?*

Fluorine, chlorine, bromine and iodine have the highest electronegativities.

These atoms are smaller and the outer electrons are, therefore, closer to the nucleus. They are held all the more tightly by the nucleus and much energy is needed to pull them away.

## **Appendix 4**

### **Statistics Used**

**This summary is derived from appendices in several other theses  
(e.g. Al-Ahmadi, 2008, pages 299-300)**

## The Chi-square Test ( $\chi^2$ )

The chi-square test is said to be one of the most widely used tests for statistical data generated by non-parametric analysis. There are two different of applications of chi-square test. These are used in this study.

### (1) Goodness of Fit Test

This tests how well the experimental (sampling) distribution fits the control (hypothesised) distribution. An example of this could be a comparison between a group of experimentally observed responses to a group of control responses. For example,

	<i>Positive</i>	<i>Neutral</i>	<i>Negative</i>	
Experimental	55	95	23	N(experimental) = 173
Control	34	100	43	N(control) = 177
				(using raw numbers)

A calculation of observed and expected frequencies lead to

	<i>Positive</i>	<i>Neutral</i>	<i>Negative</i>
<i>fo</i> = observed frequency	55	95	23
<i>fe</i> = expected frequency	33	98	42

Where  $fe = [N(\text{experimental})/N(\text{control})] \times (\text{control data})$  or  $(173/177) \times (\text{control data})$

This gives a computed value for  $\chi^2 = 23.0$  (df2)

The calculation is:

$$\frac{(55-33)^2}{33} + \frac{(95-98)^2}{98} + \frac{(23-42)^2}{42}$$

This indicates that the responses of the experimental group differ from those of the control group:

$$p < 0.001$$

This means that we over 99% confident that the responses of the experimental group differ from those of the control group. ( $\chi^2$  critical at 0.1% level = 13.8)

### Notes

Chi-square MUST be calculated using frequencies and never using percentages.

In this thesis, all data are shown percentages for clarity but all statistical calculations have been carried out using frequency data.

There are small rounding errors which will arise if chi-square is computed using a calculator compared to the more accurate results from a computer.

**(2) Contingency Test**

This chi-square test is commonly used in analysing data where two groups or variables are compared. Each of the variables may have two or more categories which are independent from each other. The data for this comparison is generated from the frequencies in the categories. In studies, the chi-square as a contingency test is used, for example, to compare two or more independent samples like year groups, gender, or ages. The data is generated from one population group. For example,

	<i>Positive</i>	<i>Neutral</i>	<i>Negative</i>
Male (experimental)	55	95	23
Female (experimental)	34	100	43

(Actual data above)

	<i>Positive</i>	<i>Neutral</i>	<i>Negative</i>	<b>N</b>
Male (experimental)	55 (44)	95 (96)	23 (33)	<b>173</b>
Female (experimental)	34 (45)	100 (99)	43 (33)	<b>177</b>
<b>Totals</b>	<b>89</b>	<b>195</b>	<b>66</b>	<b>350</b>

(Expected frequencies above in red)

The expected frequencies are shown in red in brackets ( ), and are calculated as follows:

$$\text{e.g. } 44 = (173/350) \times 89$$

$$\chi^2 = 11.1$$

At two degrees of freedom, this is significant at 1%. ( $\chi^2$  critical at 1% level = 9.21)

**Degrees of Freedom**

The degree of freedom (df) must be stated for any calculated chi-square value. The value of the degree of freedom for any analysis is obtained from the following calculations:

$$\text{df} = (r-1) \times (c-1)$$

where *r* is the number of rows and *c* is the number of columns in the contingency table.

**Sample Sizes**

There is no restriction on sample sizes except that values in each category must not drop too low. If they are too low, there is a chance that the calculation of  $\chi^2$  may occasionally produce inflated results which may lead to wrong interpretations. It is safe to impose a 10 or 5% limit on all categories. When the category falls below either of these, then categories are grouped and the df falls accordingly.

In practical terms, the ideal size of the total sample is determined by the number of categories. Thus, for example, if there are five categories (eg *strongly agree ... strongly disagree*), then the sample is better to be at least 100 and, ideally, nearer 200. However, other than minimum value restriction,  $\chi^2$  can handle samples of any size and even samples where two groups are very different in size.

## Correlation

It frequently happens that two measurements relate to each other: a high value in one is associated with a high value in the other. The extent to which any two measurements are related in this way is shown by calculating the correlation coefficient. There are three ways of calculating a correlation coefficient, depending on the type of measurement:

- (a) With integer data (like examination marks), Pearson correlation is used. This assumes an approximately normal distribution.
- (b) With ordered data (like examination grades), Spearman correlation is used. This does not assume a normal distribution.
- (c) With ordered data where there are only a small number of categories, Kendall's Tau-b correlation used. This does not assume a normal distribution.

Sometimes, the two variables to be related use different types of measurement. In this case, none of the methods is perfect and it is better to use more than one and compare outcomes. It is possible to use a Pearson correlation when one variable is integer and other is dichotomous. The coefficient is now called a point biserial coefficient.

## Factor Analysis

This technique is used to reduce a large number of variables which intercorrelate to see if there are any underlying reasons to interpret the inter-correlations. The technique identifies the number of reasons (known as factors or components) but does not indicate their nature.

In this study, Principal Components Analysis was used, with varimax rotation, using SPSS. This is the mostly commonly used technique.

The data are entered in spreadsheet format. In this study, a default eigenvalue of 1 was employed and the number of factors which exceed this value were shown. The Scree plot was also considered to ensure that the default was a reasonable decision. Different assumptions are made by different authors but, in this study, a high standard was set. For a factor structure, the variance to be explained had to exceed 70%.

The rotation procedure seeks to obtain the best fit for orthogonal axes in multi-dimensional space. This generates loadings. These are correlation coefficients of each variable with the factor. Again, there is disagreement on acceptable loadings but a minimum loading of 0.7 was set here (justification in Reid, 2006).

## **Appendix 5**

### **Bahrain Quality Assurance Authority Documentation**



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## PRE-REVIEW BRIEFING AND REVIEW PLAN FOR USE IN THE REVIEW OF SCHOOLS IN THE KINGDOM OF BAHRAIN

**School:**  
**Lead Reviewer:**  
**Date of Review:**

### Introduction

A brief, well-focused pre-Review analysis of the evidence available in the school's self-evaluation form (SEF) and clear identification of the issues that need to be followed up and focused on contribute significantly to an effective Review.

The purposes of the pre-Review briefing (PRB) are to:

- Brief the Review team to guide them through the Review
- Inform the school of the issues that are going to be focused on during the Review in order to get prepared for the Review and to arrange the evidence.

This document provides a framework for the Lead Reviewer, including an outline Review plan. The PRB should be completed by the Lead Reviewer before the Review begins. It should:

- Analyze the SEF and evaluate the validity of the school's judgements in the light of the evidence given by the school
- Focus on students' achievement, the quality of the teaching and learning process and the way in which leadership and management support and develop the quality of provision
- suggest working hypotheses and questions under the main headings of the Review schedule which will form the basis of discussions and other Review activities
- Identify the main issues that the Review team will focus on, particularly relating to students' achievement, the quality of the teaching and learning process and the effectiveness and quality of leadership and management performance.
- Outline the plan that the Review team will follow to pursue the main issues.

### Contact with the school

Before the Review begins, the Lead Reviewer should send a copy of the PRB and outline Review plan to the Principal of the school. The Principal should be given the opportunity to reply to the briefing and it should form the basis for the first meeting between the Lead Reviewer and the Principal and senior academic board members of the school.

### During the review

Reviewers will use the PRB and the SEF as the basis of their Review activities.

### Pre-Review Briefing Document



This briefing is structured to mirror the Review Framework. In each section, through analysis of the evidence provided by the school:

- Draw out the most important features, proposing hypotheses linking, where possible, the quality of provision and leadership and management with the outcomes
- Highlight issues that need to be pursued in the Review. These might be:
  - Significant matters that the SEF does not cover
  - Features of particular significance where self-evaluation judgements need checking
  - Apparent discrepancies between self-evaluation judgements and the evidence provided.

It is important to remember that the pre-Review briefing includes hypotheses, not judgements about the school; judgements are made only as a result of the Review.

### Students' achievement

<input type="checkbox"/> <b>How well do students achieve in their academic work?</b>
<b>Analysis and hypotheses</b>
<b>Issues for the review (bullet list)</b>
<input type="checkbox"/> <b>What progress do students make in their personal development?</b>
<b>Analysis and hypotheses</b>
<b>Issues for the review (bullet list)</b>

### The quality of provision

<input type="checkbox"/> <b>How effective is the teaching &amp; learning?</b>
<b>Analysis and hypotheses</b>
<b>Issues for the Review (bullet list)</b>
<input type="checkbox"/> <b>How well is the curriculum enriched and presented to students?</b>
<b>Analysis and hypotheses</b>
<b>Issues for the review (bullet list)</b>

<input type="checkbox"/> How well are students supported and guided?
Analysis and hypotheses
Issues for the review (bullet list)

### Leadership and management

<input type="checkbox"/> How effective are leadership and management in promoting good achievement and personal development and bringing about
Analysis and hypotheses
Issues for the review (bullet list)

### Overall effectiveness

<input type="checkbox"/> How effective is the school?
Overall hypotheses
The main issues for the review (bullet list)
<input type="checkbox"/>
<input type="checkbox"/> How strong is the capacity to improve?
Overall hypotheses
The main issues for the review (bullet list)

### Review plan

This plan sets out the main Review activities. Most of the Review time will be spent observing lessons, but the plan includes important meetings and other events. Review time is pressured and it is important that meetings run to time, as far as possible.

**Review team deployment**

Name of Reviewer	Responsibility

**Outline review plan**

This plan will be updated and finalised during the first morning of the Review.

Overall focus of the Review plan:		<ul style="list-style-type: none"> <li>Observation of teaching</li> <li>Gauging standards of students' work and students' progress</li> <li>Leadership and management processes to assure quality and achieve improvement</li> </ul>	
Date	Time	Review activity	Personnel
[Day 1]	07.30 – 08.15	Introductory <b>meeting with senior staff</b> to discuss PRB Place:	[Names to be inserted]
	08.15 – 08.45	<b>Team meeting</b> to finalise planning Place: team base	[Names]
	From 09.00	<b>Work scrutiny</b> [NB written work of six students from each of Grades 3, 6, 9 and 12 to be available from 09.00. The six students should represent a range of abilities. Work should be labeled to show Grade and ability level as high, average, low] Place: team base	
	08.30 –	<b>Lesson observations:</b> all grades	
	to be arranged	<b>Meeting with parents</b> [Principal to arrange for 6–10 parents to be available for a meeting]	[Name of Reviewer]
	14.30 – 15.30	<b>Review team meeting</b> Place: team base	[Names]
[Day 2]	07.15 – 07.30	Meeting of Lead Reviewer with Principal and Deputy Principal to Review day 1 and discuss reactions and concerns Place:	[Names]
	07.30 –	<b>Lesson observations:</b> all grades	
	To be arranged	<b>Meeting with [Grades a/b] students</b> [NB a group of six students to be available for ½ hour discussion] Place:	[Name of Reviewer]
	To be arranged	<b>Meeting with [Grades c/d] students</b> [NB a group of six students to be available for ½ hour discussion] Place:	[Name of Reviewer]

	To be arranged	<b>Meeting with [Grades x/y] students</b> [NB a group of six students to be available for ½ hour discussion] Place:	[Name of Reviewer]
	14.30 – 16.00	<b>Review team meeting</b> Place:	
[Day 3]	07.15 – 07.45	Meeting of lead Reviewer with Principal and Deputy Principal to discuss reactions and concerns and Review findings so far Place:	[Names]
	07.30 –	<b>Lesson observations:</b> all grades	
	10.50 – 12.20	<b>Review team meeting</b> Place:	
	12.30 – 14.30	<b>Feedback to Senior Staff</b> Place:	[Names of those to be present]
<b>Meetings to be arranged by the school</b> (for confirmation at the 07.30 meeting on day 1 of the Review)			
[Day 1]		Parents (see above)	
[Day 2]		Students (see above)	
Other meetings to be arranged around the above plan:			
[Day 1]		Principal alone (45 minutes): quality assurance; strategic planning	[Name of Reviewer]
[Day 1 or 2]		Deputy principal alone (45 minutes): academic performance; quality assurance; staff deployment and development	[Name of Reviewer]
[Day 1 or 2]		Two members of the academic committee (together): curriculum; quality assurance; staff deployment and development	[Name of Reviewer]
[Day 1 or 2]		Two senior teachers (together) (45 minutes): academic performance; teaching [NB suggest two senior teachers of Arabic, English, mathematics or science]	[Name of Reviewer]
[Day 1 or 2]		Two or three subject teachers (together) (30 minutes): teaching, supervision, deployment and development	[Name of Reviewer]
[Day 1 or 2]		Teachers responsible for support for students with learning difficulties or disabilities and for the gifted and talented	[Name of Reviewer]



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## The Review Framework

### For Use in the Review of Schools

#### Introduction

This framework sets out the evaluation requirements to be used in the Review of schools in the Kingdom of Bahrain. It lists the main questions that Reviewers must pursue to arrive at an answer to the overall question **‘How effective is the school and why?’** considering:

- Students’ achievement
  - How well students achieve in their academic work
  - Students’ progress in their personal development
- The quality of provision
  - The effectiveness of teaching and learning
  - How well the curriculum is enriched and presented
  - How well students are supported and guided
- Leadership and management
  - The effectiveness of leadership and management in promoting high achievement and strong personal development and in bringing about improvement in the school

The main questions are shown by '□' and Reviewers’ responses should be made on the evaluation scale:

- 1: ‘Outstanding’
- 2: ‘Good’
- 3: ‘Satisfactory’
- 4: ‘Inadequate’

In reaching their judgements, Reviewers will consider:

- The extent to which particular practices and procedures are in place.
- The **quality** of practice in elements which contribute to the main question.

Compliance with particular practices and procedures (shown by ‘■’ in the schedule) is judged on a scale:

- 1: Always
- 2: Often
- 3: Never

Judgements about the quality of practice in elements which contribute to the main questions (shown by ‘❖’ in the schedule) are made on the same four-point evaluation scale as the main questions.

As well as forming the basis of school Review, this framework and the evaluation scale should be used by the school in its self-evaluation.

## The review framework

### Overall effectiveness

#### ☐ How effective is the school in meeting the needs of students and their parents?

The judgement should be based on the extent to which leadership and management and provision in the school enable students to achieve as well as they can academically and in their personal development. It should take into account the extent to which:

- ❖ Students are satisfied with the school
- ❖ Parents are satisfied with the school

#### ☐ How strong is the school's capacity to improve?

The judgement should be based on the extent to which strategic planning is focused on improvement and on how well self-evaluation and other management processes are used to assure quality and improve teaching, learning and achievement. It should also consider the extent to which:

- ❖ The school has improved in recent years

Reviewers will assess the strengths and the areas of improvement in the school and identify **what steps the school should take to improve further.**

### Students' achievement

#### ☐ How well do students achieve in their academic work?

In arriving at a judgement, consider whether:

- Assessments are made of students' ability on entry to the school.
- Records of students' achievements are kept.
- Performance results are analysed.

But **particularly** the extent to which:

- ❖ In general students achieve at least the standards expected.
- ❖ Students make at least the expected progress in comparison to their prior attainment.
- ❖ Students achieve standards appropriate to their abilities.

#### ☐ What progress do students make in their personal development?

In arriving at a judgement, consider whether:

- Records are kept of students' attendance.
- Records are kept of students' punctuality.
- Incidents of poor behaviour and action taken are logged.

But **particularly** the extent to which students:

- ❖ Attend school regularly and punctually.
- ❖ Contribute fully and eagerly to school life.
- ❖ Develop self-confidence and the capacity to work independently and take responsibility.
- ❖ Develop the ability to think analytically.
- ❖ Work effectively together, respecting the views, feelings and beliefs of others.
- ❖ Behave with awareness and responsibility in the classroom and around the school.
- ❖ Feel safe and secure in school and are free from intimidatory behaviour.

## The quality of provision

### □ How effective is the teaching and learning

In arriving at a judgement, consider whether:

- Teachers have lesson plans which guide their teaching.
- Lessons start and end on time.
- Learning objectives are shared with the class and pursued
- Students' work is marked.

But **particularly** the extent to which teachers:

- ❖ Have strong knowledge of the subject and its content.
- ❖ Enable students' acquisition of skills, understanding and knowledge.
- ❖ Manage lessons effectively so that they are orderly and productive.
- ❖ Secure students' engagement, motivate, encourage and support them.
- ❖ Challenge students so that they make at least the expected progress in relation to their prior attainment.
- ❖ Use teaching and learning strategies and resources which lead to effective learning.
- ❖ Consolidate and extend work done in school through homework.
- ❖ Give students opportunities to work together and learn from each other.
- ❖ Use assessment, including marking, effectively to diagnose and fulfill students' needs.

### □ How well is the curriculum enriched and presented to students?

In arriving at a judgement, consider whether:

- The school has schemes of work which show how the statutory curriculum should be taught.
- Records are kept of students' participation in extra-curricular activities.

But **particularly** the extent to which:

- ❖ The school seeks to develop students' understanding of the rights and responsibilities of being part of a community.
- ❖ Links are made across subjects so that students experience a coherent curriculum.
- ❖ Extra-curricular activities enhance students' experiences and promote wide-ranging interests.
- ❖ The curriculum is enriched by the school environment and encourages students to respect and value their surroundings.
- ❖ The curriculum adequately prepares students to acquire basic skills.

### □ How well are students supported and guided?

In arriving at a judgement, consider whether:

- Records are kept of students' personal and academic progress and the advice they receive.
- Information about curriculum and other choices is provided for students.
- Students have access to staff for guidance and support.
- Regular information is sent to parents about their children's progress.
- The school has rules and routines defining acceptable behavior.
- The school carries out risk assessments relating to health and safety.

But **particularly** the extent to which:

- ❖ Students are inducted into the school in a way that helps them settle quickly and easily.
- ❖ The school assesses and monitors students' personal and learning needs so that their needs can be met.
- ❖ Students are sensitively supported and helped when they have problems.
- ❖ Students have access to well-informed advice and guidance when they need them.
- ❖ Parents are well-informed about students' progress.
- ❖ Students and the school's administration and academic staff work in a healthy and safe environment.
- ❖ Students are prepared effectively for the next phase of education or employment.

## **Leadership and management**

- ☐ **How effective are leadership and management in promoting high achievement and personal development and bringing about improvement?**

In arriving at a judgement, consider whether:

- Leaders and managers have clear job descriptions which set out their responsibilities.
- The school regularly seeks parents' and students' views about its provision.
- The school plans its development and improvement.
- Results over time are recorded and analysed.
- Procedures for monitoring the school's performance and provision are in place.
- Records are kept of teachers' professional development needs and opportunities they have taken up.

But **particularly** the extent to which:

- ❖ The Principal and others with leadership responsibilities have a clear vision for the school, focused on achievement, which is shared with and by staff.
- ❖ Strategic planning is firmly focused on improvement.
- ❖ Leaders inspire, motivate and support staff effectively.
- ❖ Self-evaluation, including the analysis of performance, is rigorous and used to assure quality and bring about further improvement.
- ❖ Staff are effectively managed, developed and efficiently deployed.
- ❖ Resources, including finance, accommodation and learning resources, are used effectively and efficiently.
- ❖ The school seeks and is responsive to the views of students, parents and the community about its provision.





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## SELF-EVALUATION FORM (SEF)

### FOR USE IN THE REVIEW OF SCHOOLS IN THE KINGDOM OF

### School:

### Date of completion of SEF:

## Introduction

This Self-Evaluation Form (SEF) is designed to:

- Be used as the basis of the Review of your school
- Help you in your self-evaluation.

It consists of two parts:

Part A: Information about the school and its characteristics

Part B: Self-evaluation

The SEF is a summary of what you know about your school, and includes opportunities to record judgements and present evidence regarding different aspects of it. It is laid out in sections that correspond with those in the Review Framework, except that in the SEF the section on 'The overall effectiveness of the school' is at the end.

In the SEF, you should be open and accurate in your diagnosis of the school, and support your conclusions with the main evidence you have available. It should set out what you see as the strengths of the school and what needs to be improved. How well a school knows itself, recognises what needs to be done and uses its self-evaluation to improve the school are important factors in Reviewers' judgements about leadership and management and the school's capacity to improve. More information about how Reviewers use the SEF is included in Review Guidance. Self-evaluation and the SEF are very important in the school Review.

When you complete the form, it is not necessary to give all the evidence that you have to support your judgements; give the most important evidence which helps you to know how good or weak aspects of the school are.

Section A of the SEF asks for factual information about the school, which should be as up to date as possible.

Each section of the SEF asks you to make judgements and to grade them on a four-point scale. At the end of Part B you are asked to consider the overall effectiveness of the school and how well placed you feel the school is to improve further; your judgements, again, should be on the four-point scale. The scale is:

- 1: Outstanding
- 2: Good
- 3: Satisfactory
- 4: Inadequate

Review Guidance includes an interpretation of these grade descriptions. It also includes guidance on the characteristics to consider when making judgements and how to pitch judgements on the four-point scale. This guidance is for schools and Reviewers.

In the sections of the SEF, you are also asked to record the extent to which certain procedures and practices are in place in the school. These judgements are made on a three-point scale, which is also explained in Review Guidance:

- 1: Always
- 2: Sometimes
- 3: Not in place

Again, Review Guidance includes an interpretation of this scale.

## Part A: Information about the school and its characteristics

The first part of this section asks you to outline the main characteristics of the school, while the second asks for data and other information about it. The first part will draw on information you have about the students and their backgrounds.

### Characteristics of the school

- a What are the main characteristics of the student population in the school?  
– consider (a) the ability of students on entry to the school and how you know and (b) the social and economic background of students

- b What is the distinctive vision of the school and its aims?

- c Have there been any recent major changes in the school or its context?

- d Are there any particular features that aid or inhibit the school's performance?  
– consider such features as: staffing; changes in leadership; the support from parents and their expectations of the school; resources.

## Factual information about the school

The factual information required is set out in sections, as follows:

Section A:	The school
Section B:	Students
Section C:	Staff
Section D:	Curriculum
Section E:	Students' achievements

### Section A: The school

A1 Name of the school

A2 Stage and gender (if appropriate)

A3 Age range of students

A4 Name of Principal

A5 School address

A6 Telephone/fax number

A7 Email address

A8 Website address

A9 Any unusual features

Please include any specialist provision, for example for a group of schools or special facilities for students with disabilities

**Section B: Students****B1 Numbers of students**

Stage	Grade	Number of Students	Number of Classes
Primary (1 <sup>st</sup> cycle)	1		
	2		
	3		
Primary (2 <sup>nd</sup> cycle)	4		
	5		
	6		
Intermediate	7		
	8		
	9		
Secondary	10		
	11		
	12		
<b>Total</b>			

**B2 Attendance of students**

State last academic year's average attendance

Stage	Grade	Percentage
Primary (1 <sup>st</sup> cycle)	1	
	2	
	3	
Primary (2 <sup>nd</sup> cycle)	4	
	5	
	6	
Intermediate	7	
	8	
	9	
Secondary	10	
	11	
	12	
<b>Average</b>		

**B3 Student mobility**

Identify the total student turnover by stating the following.

**B4 Student behaviour****B5 Students with special educational needs/disabilities or gifted and talented**

Stage	Grade	Special educ. needs							
		Learning difficulties		Outstanding		Disability (physical)		Gifted & Talented	
		No	%	No	%	No	%	No	%
Primary (1 <sup>st</sup> cycle)	1								
	2								
	3								
Primary (2 <sup>nd</sup> cycle)	4								
	5								
	6								
Intermediate	7								
	8								
	9								
Secondary	10								
	11								
	12								
<b>Total</b>									

List the types of special needs or disabilities.

**B6 Nationality of students**

Nationality	Number	Percentage
Bahraini		
Non-Bahraini		

**B7 First language of students**

	Language	Number	Percentage
	Arabic		
Other languages (highest number at top)			

**B8 Parents' education level**

Indicate highest level of qualification.

Classification (at least one parent)	Number	Percentage
Illiterate		
Literate in Arabic		
Literate in another language		
Secondary Certificate		
University Degree		
Other Professional or Academic Qualification		

**B9 Socio-economic information**

Classification	Number	Percentage
Employed (at least one parent)		
Children who live with just one of their parents		
Children who do not live with their parents		
Children who receive free school meals		
Children who receive winter support		

**Section C: Staff****C1 Number and nationality of teaching staff**

	Bahraini	Non-Bahraini	Total
Number of teachers			
Number of qualified teachers (university degree plus educational qualification)			
Number of substitute teachers			

**C2 Attendance of teachers**

Note: To calculate the average number of absences, divide the total number of absent teacher days by the total number of teachers.

Total number of absent teacher days	
Average number of absences	

**C3 Senior academic, administrative and other staff**

Please give the numbers of senior academic staff (including the principal and deputy principals), administrative or clerical staff and other staff including counsellors or similar staff, but exclude cleaners and other maintenance staff

Senior staff, including the Principal and deputy principals	
Administrative/clerical staff	
Other staff	

**C4 Deployment of staff**

Please complete the annex at the end of this SEF to show the staff, their responsibilities and, if they are teachers, the number of lessons they teach and the number when they do not have class contact.

**C5 Teacher mobility**

Please give the number of teachers who took up their appointments in the last **academic** year or who left in the same period.

Number of teachers who took up their appointments last year	
Number of teachers who left last year	

**Section D: Curriculum****D1 Teaching time for each stage**

Please give the number of lessons taught each week at each stage

Stage	Grade	No of lessons per week
Primary(1 <sup>st</sup> cycle)	1–3	
Primary (2 <sup>nd</sup> cycle)	4–6	
Intermediate	7–9	
Secondary	10–12	

Duration of each lesson	Minutes
-------------------------	---------

**D2 Subjects taught and time allocations**

Please give the number of lessons allocated to subjects of the curriculum in each stage, adding any subjects that are not listed (except extra-curricular activities).

**A. Primary (1<sup>st</sup> and 2<sup>nd</sup> cycles)**

Subject	Number of lessons					
	Primary (1 <sup>st</sup> cycle) – Grades			Primary (2 <sup>nd</sup> cycle) – Grades		
	1	2	3	4	5	6
Islamic education						
Arabic language						
English language						
Mathematics						
Science & technology						
Social studies						
Family-life education						
Physical education						
Fine arts						
Songs and music						
Information						
Design & technology						

## B. Intermediate and secondary

Subject	Number of lessons					
	Intermediate – Grades			Secondary – Grades		
	7	8	9	10	11	12
Islamic education						
Arabic language						
English language						
Mathematics						
Science & technology						
Social studies						
Family–life education						
Physical education						
Fine arts						
Practical studies						
Information						
Design & technology						

## D3 Extra-curricular activities

Please give a list of extra curricular activities in different cycles, indicating the numbers of students involved.

Activity	Cycle	No. of Students Involved



**Section E: Students' achievements****E1 Subject standards** State the percentages of the number of students in each category.

Cycle	Grade	Category	Arabic	Math	Science	English
First Cycle	1	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	2	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	3	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
Second Cycle	4	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	5	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	6	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				

Cycle	Grade	Category	Arabic	Math	Science	English
Third Cycle	7	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	8	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	9	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
Fourth Cycle	10	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	11	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				
	12	90 to 100				
		80 to 89				
		70 to 79				
		60 to 69				
		50 to 59				
		Less than 50				

**E2 Subject standards**

Please give the proportions of students who passed school exams for listed subjects at the ends of the years listed.

**B. Primary (1<sup>st</sup> and 2<sup>nd</sup> cycles)**

Subject	% students reaching expected standard for last academic					
	Primary (1 <sup>st</sup> cycle) – Grades			Primary (2 <sup>nd</sup> cycle) – Grades		
	1	2	3	4	5	6
Islamic education						
Arabic language						
English language						
Mathematics						
Science & technology						
Social studies						
Family–life education						
Physical education						
Fine arts						
Songs and music						
Information technology						
Design & technology						

**C. Intermediate and secondary**

Subject	% students reaching expected standard for last academic					
	Intermediate – Grades			Secondary – Grades		
	7	8	9	10	11	12
Islamic education						
Arabic language						
English language						
Mathematics						
Science & technology						
Social studies						
Family–life education						
Physical education						
Fine arts						
Practical studies						
Information technology						
Design & technology						

**E3 Students repeating course programmes**

Give the numbers of students in each grade who are repeating a previous year's course

Grade	Number of students repeating previous year's course
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

**E4 Students who have left or transferred, and where they went (intermediate and secondary stages)**

Please give the numbers of students who left or transferred from the school at the end of or during the last academic year from the following grades; where known, please indicate their destinations.

Grade	Number leaving	Destination			
		Secondary education or further education or training other than university	University	Work	Not known
9					
10					
11					
12					

**Annex: Staff and their deployment**

In the table below please list the staff of the school, their responsibilities and, in the case of teachers, their deployment. Please include the Principal and other leaders and managers in the school, key administrative staff and teachers. Please do not include cleaners, maintenance or similar staff.

Name	Role/responsibility	Stage in which teachers work (primary, intermediate or secondary)	Number of lessons taught

**Part B: Self-evaluation**

## Students' achievement

### □ How well do students achieve in their academic work?

To help focus your evidence and judgements in this section, consider the criteria set out below and the commentary in Review Guidance. Refer to the main evidence such as any performance records for the school and for groups of students. Please consider how well students achieve in different phases of education in the school.

Consider the extent to which:

- ❖ Students generally at least meet the standards expected for their age
- ❖ Students make at least the expected progress relative to their prior attainment
- ❖ Students achieve standards appropriate to their abilities

1a How well do students achieve in Grades 1–3?

--

1b How well do students achieve in Grades 4–6?

--

1c How well do students achieve in Grades 7–9?

--

1d How well do students achieve in Grades 10–12?

--

### Summary evaluations relating to students' academic achievement

Please complete the following **audit of procedures and practices**. Respond using the three point scale: 1:always 2: often 3: never

Assessments are made of students' ability on entry to the school	
Records of students' achievements are kept	
Performance results are analysed	

Please record your **self-evaluation judgement** on each of the following criteria and for students' achievement overall. Refer to Review Guidance in making your judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

Students generally at least meet the standards expected for their age	
Students make at least the expected progress relative to their prior attainment	

Students achieve standards appropriate to their abilities	
<b>Students' achievement in their academic work</b>	

□ **What progress do students make in their personal development?**

To help focus your evidence and judgements in this section, consider the criteria set out below and the commentary in Review Guidance. In this section, please focus on outcomes, not processes.

Consider the extent to which students:

- ❖ Attend school regularly and punctually.
- ❖ Participate actively and enthusiastically in school life.
- ❖ Develop self-confidence and the capacity to work independently and take responsibility.
- ❖ Develop the ability to think analytically.
- ❖ Work effectively together, respecting the views, feelings and beliefs of others.
- ❖ Behave with awareness and responsibility in the classroom and around the school.
- ❖ Feel safe and secure in school and are free from intimidating and threatening behaviour.

2a How good are attendance and punctuality?

--

2b How actively and enthusiastically do students participate in school life?

--

2c How well developed are students' self-confidence, their capacity to work both independently and with each other, and their ability to think analytically?

--

2d To what extent do students behave with awareness and responsibility in the classroom and around the school?

--

2e To what extent are students safe and secure in school and free from intimidatory and threatening behaviour?

--

### Summary evaluations relating to students' personal development

Please complete the following **audit of procedures and practices**. Respond using the three point scale: 1:always 2: often 3: never

Records are kept of students' attendance	
Records are kept of students' punctuality	
Incidents of poor behaviour and action taken are logged	

Please record your **self-evaluation judgement** on each of the following criteria and for students' personal development overall. Refer to Review Guidance in making your judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

Students attend school regularly and punctually	
Students participate actively and enthusiastically in school life	
Students develop self-confidence and the capacity to work independently and take responsibility	
Students develop the ability to think analytically	
Students work effectively together, respecting the views, feelings and beliefs of others	
Students behave with awareness and responsibility in the classroom and around the school	
Students feel safe and secure in school and are free from intimidating and threatening behaviour	
<b>The progress of students in their personal development</b>	

## The quality of provision

### □ How effective is the teaching and learning process?

To help focus your evidence and judgements in this section, consider the criteria set out below and the commentary in Review Guidance. Your evaluation should take account of the effect of teaching on the students' achievement and personal development.

Consider the extent to which teachers:

- ❖ Have good knowledge of the subject and the study material.
- ❖ Manage lessons effectively so that they are orderly and productive.
- ❖ Enable students' acquisition of skills, understanding and knowledge.
- ❖ Involve students in the lesson, and support, motivate and encourage them.
- ❖ Challenge students so that they make at least the progress expected of them.
- ❖ Employ teaching and learning strategies, and use resources which lead to effective learning.
- ❖ Support and extend work done in school through giving homework.
- ❖ Give students opportunities to work together and learn from each other.
- ❖ Use assessment, including marking, to diagnose and meet students' needs.

#### 3a How effective is the teaching and learning process?

- consider particularly teachers' subject and course knowledge, lesson management, teaching methodology and ability to challenge and motivate students

--

#### 3b How effective is the use of homework?

--

#### 3c How effectively is assessment used?

--

### Summary of evaluations relating to the effectiveness of the teaching and learning process

Please complete the following **audit of procedures and practices**. Respond using the three point scale: 1:always 2: often 3: never

Teachers have lesson plans which guide their teaching	
Lessons start and end on time	
Learning objectives are shared with the class and pursued	
Students' work is marked	

Please record your self-evaluation judgement on each of the following criteria and for the effectiveness of teaching overall. Refer to Review Guidance in making your



judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

Teachers' knowledge of subject and study material	
Teachers enable students' acquisition of skills, understanding and also knowledge	
Teachers manage lessons effectively so that they are orderly and productive	
Teachers involve students in the lesson, and support, motivate and encourage	
Teachers challenge students, so that they make at least the progress expected of	
Teachers employ teaching and learning strategies, and use resources which lead to effective learning	
Teachers support and extend work done in school through giving students	
Teachers give students opportunities to work together and learn from each other	
Assessment, including marking, is used effectively to diagnose and meet	
<b>The effectiveness of the teaching and learning process</b>	

☐ **How well is the curriculum enriched and presented to students?**

To help focus your evidence and judgements in this section, consider the criteria set out below and the commentary in Review Guidance. Your evaluation should take account of the effect of the curriculum on students' achievement and personal development.

Consider the extent to which:

- ❖ The school seeks to develop students' understanding of the rights and responsibilities of being part of a community.
- ❖ Links are made across subjects so that students experience a coherent curriculum.
- ❖ Extra-curricular activities enhance students' experiences and promote wide-ranging interests.
- ❖ The curriculum is enriched by the school environment and encourages students to respect and value their surroundings.
- ❖ The curriculum adequately prepares students to acquire the basic skills.

**4a How well is the curriculum presented to students?**

- consider how well it is used to develop understanding and skills as well as factual knowledge, to develop understanding of being part of a community and to prepare students for the next phases of education or employment.

--

**4b How well is the curriculum enhanced and enriched?**

- consider the provision for extra-curricular activities and how well the school environment is used to enrich the curriculum.

--

### Summary evaluations relating to the curriculum

Please complete the following **audit of procedures and practices**. Respond using the three point scale: 1:always 2: often 3: never

The school has schemes of work which show how the curriculum should be taught	
Records are kept of students' involvement in extra-curricular activities	

Please record your **self-evaluation judgement** on each of the following criteria and for the enrichment and presentation of the curriculum overall. Refer to Review Guidance in making your judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

Students' understanding of the rights and responsibilities of being part of a community are developed	
Links across subjects enable students to experience a coherent curriculum	
Extra-curricular activities enhance students' experiences and promote wide-ranging interests	
The school environment enriches the curriculum and students are encouraged to value their surroundings	
The curriculum adequately prepares students to acquire the basic skills	
<b>How well the curriculum is enriched and presented to students</b>	

#### ☐ How well are students supported and guided?

To help focus your evidence and judgements in this section, consider the criteria set out below and the commentary in Review Guidance. Your evaluation should take account of the support and guidance of students on their achievement and personal development.

Consider the extent to which:

- ❖ Students are inducted into the school in a way that helps them settle quickly and easily.
- ❖ The school assesses and monitors students' personal and learning needs so that their needs can be met.
- ❖ Students are sensitively supported and helped when they have problems.
- ❖ Students have access to well-informed advice and guidance when they need them, particularly on curricular choices they have to make about further and higher education and employment.
- ❖ Parents are well-informed about students' progress.
- ❖ The school ensures that students and staff work in a healthy and safe environment.
- ❖ Students are prepared effectively for the next phase of education.

5a How effectively are students supported and guided?

--

### Summary evaluations relating to support and guidance

Please complete the following **audit of procedures and practices**. Respond using the three point scale: 1:always 2: often 3: never

Records are kept of students' personal and academic progress and the advice they	
Information about curriculum and other choices is provided for students	
Students have access to staff for guidance and support	
Regular information is sent to parents about their children's progress	
The school has rules and routines defining acceptable behavior	
The school carries out risk assessments relating to health and safety	

Please record your **self-evaluation judgement** on each of the following criteria and for the support and guidance of students overall. Refer to Review Guidance in making your judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

Students are inducted into the school in a way that helps them settle quickly and	
The school assesses students' personal and learning needs so that their needs can	
Students are sensitively supported and helped when they have problems	
Students have access to well-informed advice and guidance when they need them	
Parents are well-informed about students' progress	
The school ensures that students and staff work in a healthy and safe	
Students are prepared effectively for the next phase of education.	
<b>How well students are supported and guided</b>	

### Leadership and management

- **How effective are leadership and management in promoting good achievement and personal development and bringing about improvement?**

To help focus your evidence and judgements in this section, consider the criteria set out below and the commentary in Review Guidance. Your evaluation should take account of the impact of leadership and management on the quality of provision, particularly teaching, and students' achievement.

Consider the extent to which:

- ❖ The Principal and others with leadership responsibilities have a clear vision for the school, focused on achievement, which is shared with and by staff.
- ❖ Strategic planning is firmly focused on improvement.
- ❖ Leaders inspire, motivate and support staff effectively.
- ❖ Self-evaluation, including the analysis of performance, is rigorous and used to assure quality and bring about further improvement.
- ❖ Staff are effectively managed, developed and efficiently deployed.
- ❖ Resources, including finance, accommodation and learning resources, are effectively and efficiently used.
- ❖ The school seeks and is responsive to the views of students and parents about its provision.

6a How effective are leadership and management?

--

### Summary evaluations relating to Leadership and management

Please complete the following **audit of procedures and practices**. Respond using the three point scale: 1:always 2: often 3: never

Leaders and managers have job descriptions which set out their responsibilities	
The school regularly seeks parents' and students' views about its provision	
The school plans its development and improvement	
Results over time are recorded and analysed	
Procedures for monitoring the school's performance and provision are in place	
Records are kept of teachers' professional development needs and the	

Please record your **self-evaluation judgement** on each of the following criteria and for the effectiveness of leadership and management overall. Refer to Review Guidance in making your judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

The Principal and other leaders have a clear vision, focused on achievement, which is shared with staff	
Strategic planning is firmly focused on improvement	
Leaders inspire, motivate and support staff effectively	
Self-evaluation is rigorous and is used to assure quality and bring about	
The management and development of teaching and administrative staff is undertaken effectively, and they are appropriately deployed	
Resources, including finance, accommodation and learning resources, are effectively and efficiently used	
The school seeks and is responsive to the views of students, parents and community about its provision	
<b>The effectiveness of leadership and management</b>	

## Overall effectiveness

☐ How effective is the school in meeting the needs of students and their parents?

7a Based on the Review criteria, explain why you judge your school's overall effectiveness as outstanding (1), good (2), satisfactory (3) or inadequate (4)?

The school is outstanding/ good/ satisfactory/ inadequate (delete as appropriate) because:

7b What do you know about students' satisfaction with the school?  
– include comments on how you know

7c What do you know about parents' views of the school?  
– include comments on how you know

## Summary evaluations relating to the overall effectiveness of the school

Please record your **self-evaluation** judgement about the satisfaction of parents and students and the overall effectiveness of the school. Refer to Review Guidance in making your judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

Students' satisfaction with the school	
Parents' satisfaction with the school	
<b>The overall effectiveness of the school</b>	

## Priorities for improvement

What are the key priorities for improving the school as a whole?

- 
- 

☐ How strong is the school's capacity to improve?

To answer this question, you should draw together your evaluations from previous sections, particularly leadership and management. You should give greatest weight to the rigour of self-evaluation, the school's strategic planning and how well staff is deployed, managed and developed to enable improvement to take place. You will also find it helpful to refer to Review Guidance.

8a How strong is the school's capacity to improve?

--

### Summary evaluations relating to the capacity to improve

Please record your **self-evaluation** judgement about the school's improvement in the past and its capacity for further improvement. Refer to Review Guidance in making your judgement on the four-point scale: 1: outstanding; 2: good; 3: satisfactory; 4: inadequate.

The school's improvement in recent years	
<b>The school's capacity to improve</b>	

## **Appendix 6**

### **Permissions Documentation**



School of Education, Social Work & Community Education

Dean of School  
Professor Yolande Muschamp

School Secretary  
Julie Christie

9<sup>th</sup> April, 2010

Dr Abdula Almatawa  
Under-Secretary of Education and Curriculum Affairs  
Ministry of Education  
Kingdom of Bahrain

Dear Dr Almatawa

**Mr Khalid Almadani**

Mr Almadani is studying for his PhD in education at the University of Dundee. His study area relates to quality assurance and evaluation of education in the context of secondary education.

As a first stage of his study, Mr Almadani is planning to survey the situation in the Kingdom of Bahrain by using a brief survey (which is attached) and conducting some interviews. The aim is to find out how the various people involved understand the current system of quality assurance and evaluation, and how they see its value in enhancing secondary education in the Kingdom.

For this project, he would need access to teachers, various groups involved in education in the Kingdom and some pupils and teachers. The survey will take less than 15 minutes to complete while the interviews are planned to last 25-30 minutes. In all of this, no individual will be identified at all and all his data will be presented anonymously.

The aim is to build up a clear picture of current procedures and how these are seen. Meantime, Mr Almadani is reading the research literature widely and hopes to be able to explore new ways forward in assessing quality. The ultimate aim is that his research will lead to developments which will prove to be of value in enhancing the educational provision at secondary stages in the Kingdom of Bahrain.

I hope you will be able to assist him in enabling this study to proceed.

Thank you

Yours sincerely

A handwritten signature in black ink, appearing to read 'Norman Reid'.

Professor Norman Reid

A handwritten signature in black ink, appearing to read 'Susan Rodrigues'.

Professor Susan Rodrigues

(supervisors)

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School of Education, Social Work & Community Education

Dean of School  
Professor Yolande Muschamp

School Secretary  
Julie Christie

9<sup>th</sup> April, 2010

Dr Masooma Abdasuheb  
Director of Scientific Research  
Ministry of Education  
Kingdom of Bahrain

Dear Dr Masooma Abdasuheb

**Mr Khalid Almadani**

Mr Almadani is studying for his PhD in education at the University of Dundee. His study area relates to quality assurance and evaluation of education in the context of secondary education.

As a first stage of his study, Mr Almadani is planning to survey the situation in the Kingdom of Bahrain by using a brief survey (which is attached) and conducting some interviews. The aim is to find out how the various people involved understand the current system of quality assurance and evaluation, and how they see its value in enhancing secondary education in the Kingdom.

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The aim is to build up a clear picture of current procedures and how these are seen. Meantime, Mr Almadani is reading the research literature widely and hopes to be able to explore new ways forward in assessing quality. The ultimate aim is that his research will lead to developments which will prove to be of value in enhancing the educational provision at secondary stages in the Kingdom of Bahrain.

I hope you will be able to assist him in enabling this study to proceed.

Thank you

Yours sincerely

A handwritten signature in black ink, appearing to read 'N Reid'.

Professor Norman Reid

A handwritten signature in black ink, appearing to read 'S Rodrigues'.

Professor Susan Rodrigues

(supervisors)



School of Education, Old Medical Building  
University of Dundee, Nethergate, Dundee, Scotland, DD1 4HN

From: Professor Norman Reid, BSc, MA, PhD, FRSA, FRSC.  
E-Mails: [N.Reid@dundee.ac.uk](mailto:N.Reid@dundee.ac.uk), [dr\\_n@btinternet.com](mailto:dr_n@btinternet.com)

4<sup>th</sup> May 2010

Dr Jawaher Al Mudhaki  
Chief Executive of Quality Assurance Authority for Education and Training  
Kingdom of Bahrain

Dear Dr Al Mudhaki

**Mr Khalid Almadani**

Mr Almadani is studying for his PhD in education at the University of Dundee. His study area relates to quality assurance as it is developed in secondary education.

As a first stage of his study, Almadani is planning to survey the situation in the Kingdom of Bahrain by using a brief survey and conducting some interviews. The aim is to find out how the various people involved understand the current system of quality assurance and how they see its value in enhancing secondary education in the Kingdom.

For this project, it would be helpful if he could interview yourself and directors and some of staff in the Quality Assurance Authority for Education and Training.

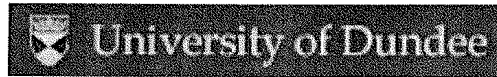
The aim is to build up a clear picture of what is going on. Meantime, Mr Almadani is reading the research literature widely and hopes to be able to explore new way forward in assessing quality. The ultimate aim is that his research will lead to developments which will prove to be of value in enhancing the educational provision at secondary stages in the Kingdom of Bahrain.

I hope you will be able to assist him in enabling this study to proceed.

Thank you

A handwritten signature in cursive script, appearing to read "Norman Reid".

Professor Norman Reid  
(supervisor)



School of Education, Old Medical Building  
University of Dundee, Nethergate, Dundee, Scotland, DD1 4HN

From: Professor Norman Reid, BSc, MA, PhD, FRSA, FRSC.  
E-Mail: [N.Reid@dundee.ac.uk](mailto:N.Reid@dundee.ac.uk), [dr\\_n@btinternet.com](mailto:dr_n@btinternet.com)

26th May 2011

Dr Abdulla Al-Matwa  
Under-Secretary for Curriculum and Education  
Ministry of Education  
Kingdom of Bahrain

**Statistical Analysis - Data Sought**  
**PhD Project: Khaled Al-Madani**

On behalf of Mr Khaled Al-Madani, I am seeking your help in gaining access to a large amount of examination data. His work is exploring aspects of Quality Assurance in Secondary Education. The first part of Mr Al-Madani's work for his PhD has gone very well and has given him some fascinating and very useful insights. Part of his work for the next stage is to look into examination data.

His aim is to run a sophisticated statistical technique (Principal Components Analysis) applied to examination marks for a large number of subjects to explore how many aspects of learning the examinations are measuring. The outcomes will not be related specifically to Bahrain but may well apply much more widely. Earlier data on a more limited scale from two other countries has proved interesting. No school or individual student will be identified in the analysis.

Ideally, what Mr Al-Madani needs is a computer spreadsheet of the data, giving the marks for *every* student for *every* course taken during their *final year* at secondary school (*both* semesters) for, say, the year 2010 (2009 as well will help).

If that is not possible, can he have access to a spreadsheet of the marks for the core subjects (2 courses in Islamic Studies, 2 in Arabic, 2 in English, 3 in Mathematics, 2 in Social Studies, 1 in Environmental Science), plus the marks for those who elected to take course in Biology (possibly 3 courses), Chemistry (possibly 5 courses), Physics (possibly 3 courses), and Mathematics (possibly 5 courses).

I guarantee that any data given to him will be kept secret and that no one other than Mr Al-Madani and myself will have access to it. The data will then be destroyed.

I am very grateful for you for considering this request

I hope you can assist Mr Al-Madani

Yours sincerely

A handwritten signature in cursive script, appearing to read "Norman Reid".

Norman Reid



School of Education, Old Medical Building  
University of Dundee, Nethergate, Dundee, Scotland, DD1 4HN

From: Professor Norman Reid, BSc, MA, PhD, FRSA, FRSC.

18<sup>th</sup> November 2011

Dr Abdula Almatawa  
Under Secretary for Educational Affairs and Curriculum  
Ministry of Education  
Kingdom of Bahrain

Dear Dr Abdula Almatawa

**Mr Khaled Al-Madani**  
**PhD Student**

For the final stage of his work for his PhD, Mr Al-Madani has developed some teaching units which he wishes to use with secondary school students in the Kingdom of Bahrain. He hopes to assess their effectiveness and to see how this approach might contribute to quality.

For this purpose, he needs access to up to 6 schools. I hope you can assist in making this possible.

Thank you

Yours sincerely

A handwritten signature in cursive script, appearing to read "Norman Reid".

*Honorary Professor of Science Education, University of Dundee*  
*Emeritus Professor of Science Education, University of Glasgow*  
*Honorary Senior Research Fellow, Department of Physics, University of Glasgow*  
*E-Mail: N.Reid@dundee.ac.uk, dr\_n@btinternet.com*

**Kingdom of Bahrain**  
**Ministry of Education**  
 Secretariat General of the Higher  
 Education Council  
 Scientific Research Directorate



مملكة البحرين  
 وزارة التربية والتعليم  
 الأمانة العامة لمجلس التعليم العالي  
 إدارة البحث العلمي

التاريخ : ١٣ مايو ٢٠١٠م

الرقم : ٥ / ٤٩ / ت م ب

حضرة الفاضل خالد أحمد المدني المحترم

تحية طيبة وبعد .....

الموضوع

الموافقة على تطبيق أدوات بحث بوزارة التربية والتعليم ومدارسها

بالإشارة إلى طلبكم المقدم بتاريخ ٣ / ٥ / ٢٠١٠ م بشأن تطبيق أدوات البحث:

ضمان الجودة في التعليم الثانوي في مملكة البحرين

يسرني إعلامكم بموافقة الإدارة / الإدارات المعنية على تطبيق أدوات البحث وفق

التعليمات والشروط التالية:

١. الالتزام عند التطبيق بأداة / أدوات البحث التي تمت الموافقة عليها دون إضافة أو حذف .
٢. المحافظة على المعلومات التي يحصل عليها وعدم استخدامها إلا لأغراض البحث العلمي.
٣. تزويد إدارة البحث العلمي بنسخة من البحث بعد الانتهاء منه .

مع تمنياتنا لكم بالتوفيق

التوقيع

د. معصومة عبد الصاحب

مديرة إدارة البحث العلمي



**Kingdom of Bahrain**  
**Ministry of Education**  
 Secretariat General of the Higher  
 Education Council  
 Scientific Research Directorate



مملكة البحرين  
 وزارة التربية والتعليم  
 الأمانة العامة لمجلس التعليم العالي  
 إدارة البحث العلمي

رأي إدارة البحث العلمي :

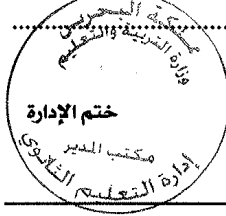
مرفقات الطلب : مكتملة (✓) غير مكتملة ( )  
 أدوات البحث : مناسبة (✓) غير مناسبة ( ) محكمة (✓) غير محكمة ( )

مدير الإدارة : د. معصومة عبد الصاحب ..... التوقيع ..... التاريخ : ٢٠١٥/٥/٢٠

رأي الإدارة / الإدارات المعنية : إدارة العلم التأليف

موضوع البحث : مقبول (✓) غير مقبول ( )

أسباب عدم القبول: .....



اعتماد مدير الإدارة : ..... الاسم : ..... التوقيع : ..... التاريخ : ٢٠١٥/٥/٢٠

رأي اللجنة المختصة :

موضوع البحث : مقبول (✓) غير مقبول ( )

أسباب القبول: ..... تم تقييم المرحلية الأولى في دراسة لاهوت بناء على الأوراق المرفقة مع

الواقع مع هذا الأثر في رأي المراجعين المرفقة مع دراسة في سبيل

أسباب عدم القبول: ..... تطوّر في جوانب البحث في سبيل

رأي لجنة الوكلاء :

الموافقة على الطلب ( ) عدم الموافقة على الطلب ( )

محضر الاجتماع رقم ..... التاريخ ..... توقيع أمين السر .....

التاريخ: ٢٠١١ / ٧ / ٨

☐ عام  
☐ عاجل  
☐ خاص و سري



## مذكرة إجراء داخلي

الرقم: 2933/2011

مملكة البحرين  
 وزارة التربية والتعليم  
 مكتب وكيل الوزارة لشؤون التعليم والمناهج

الموضوع: خطاب جامعة DUNDEE في المملكة المتحدة بخصوص خالد المدني

الإدارات ورؤساء الأقسام	الوكلاء المساعدون/المستشارون	مساعدة الوكلاء
<input type="checkbox"/> مدير إدارة البعثات والمكتبات	<input type="checkbox"/> الوكيل المساعد للخدمات التدريبية والأنشطة الطلابية	<input type="checkbox"/> مساعدة وكيل الوزارة للموارد والخدمات
<input type="checkbox"/> مدير إدارة العلاقات العامة	<input type="checkbox"/> الوكيل المساعد للمناهج والإشراف التربوي	<input type="checkbox"/> مساعدة الأمين العام لمجلس التعليم العالي
<input type="checkbox"/> مدير مشروع جلاله الملكة لنادي المستقبل	<input type="checkbox"/> الوكيل المساعد للتعليم الخاص والمستمر	
<input type="checkbox"/> مديرية إدارة المناهج	<input checked="" type="checkbox"/> الوكيل المساعد للتعليم العام والفني	
<input type="checkbox"/> مديرية إدارة الإشراف التربوي	<input type="checkbox"/> الوكيل المساعد للموارد المالية والخدمات	
<input type="checkbox"/> مديرية إدارة الامتحانات	<input type="checkbox"/> الوكيل المساعد للموارد البشرية	
<input type="checkbox"/> القلم بأعمال مدير إدارة التقنيات التربوية ومصادر التعلم	<input type="checkbox"/> الوكيل المساعد للتخطيط والمعلومات	
<input type="checkbox"/> مديرية إدارة التعليم الثانوي	<input type="checkbox"/> أمين عام مساعد للتعليم والاعتمادية	09-09-2011
<input type="checkbox"/> رئيس مركز المعلومات الجامعية وتقويم المؤهلات العلمية	<input type="checkbox"/> الأمين العام للجنة البحرين الوطنية للتربية والعلوم والثقافة	
<input type="checkbox"/> رئيسة مركز القياس والتقويم	<input type="checkbox"/> رئيس الشؤون القانونية بمكتب مساعدة الوزير	11-09-2011
<input type="checkbox"/> مدير مكتب مساعدة الوزير	<input type="checkbox"/> المستشار التربوي بمكتب مساعدة الوزير	
<input type="checkbox"/> مدير إدارة التطوعات واللجان	<input type="checkbox"/> المستشار القانوني (الشورى والتواب)	
<input type="checkbox"/> المستشار القانوني الأستاذ هاني العشري	<input type="checkbox"/> المستشار الإعلامي بمكتب مساعدة الوزير	
<input type="checkbox"/> الأستاذ عادل الموسري	<input type="checkbox"/> مستشار الدراسات والبحوث بمكتب مساعدة الوزير	

الإجراء المطلوب:		
<input type="radio"/> للتكرم بالإطلاع والتوجيه	<input checked="" type="radio"/> إجراء اللازم لطفاً	<input type="radio"/> للإفادة / للدراسة لطفاً
<input type="radio"/> للتكرم بالاعتماد	<input checked="" type="radio"/> بحسب النظام لطفاً	<input type="radio"/> لاتخاذ اللازم لطفاً
<input type="radio"/> بحسب توجيه مساعدة الوزير	<input type="radio"/> بحسب توجيه مساعدة الوزير	<input type="radio"/> لاتخاذ اللازم بحسب النظام لطفاً
<input type="radio"/> لاتخاذ اللازم	<input type="radio"/> للإفادة لطفاً	<input type="radio"/> لراجمتي في الموضوع لطفاً
<input type="radio"/> للتكرم بإبداء الرأي	<input type="radio"/> لإبداء الرأي لطفاً	<input type="radio"/> بحسب توجيه مساعدة الوزير
<input type="radio"/> للتكرم بالإطلاع والعلم	<input type="radio"/> لراجمتي في الموضوع لطفاً	<input type="radio"/> لاشتماد مساعدة الوزير
<input type="radio"/>	<input type="radio"/> لراجمتي بأوراق الموضوع لطفاً	<input type="radio"/> لراجمتي بأوراق الموضوع وخلفيته لطفاً
<input type="radio"/>	<input type="radio"/> للمتابعة لطفاً	<input type="radio"/> للتنسيق لطفاً
<input type="radio"/>	<input type="radio"/> للتعميم لطفاً	<input type="radio"/> للتعميم لطفاً
<input type="radio"/>	<input type="radio"/> لإعداد رد مناسب لطفاً	<input type="radio"/> لإعداد رد مناسب لطفاً
<input type="radio"/>	<input type="radio"/> للاعتماد لطفاً	<input type="radio"/> للمتابعة لطفاً
<input type="radio"/>	<input type="radio"/> لتعلم / للحفظ	<input type="radio"/> لتعلم / للحفظ لطفاً
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

خاص بمكتب مساعدة وكيل الوزارة لشؤون التعليم والمناهج:		
<input type="checkbox"/> مستشار تربوي في مكتب مساعدة الوزير	<input type="checkbox"/> لاتخاذ اللازم	<input type="radio"/> للإفادة
<input type="checkbox"/> مستشار إدارة وتخطيط في مكتب مساعدة الوزير	<input type="checkbox"/> مذكرة مساعدة الوزير	<input type="radio"/> لإعلام المعني
<input type="checkbox"/> رئيس التنسيق والمتابعة	<input type="checkbox"/> لراجمتي في الموضوع	<input type="radio"/> لإعداد رد مناسب
<input type="checkbox"/> منسق لجان	<input type="checkbox"/> للمتابعة	<input type="radio"/> أخرى
<input type="checkbox"/> منسق برامج		
<input type="checkbox"/> المساعد التربوي		
<input type="checkbox"/> المنسق الإداري		

التعليق:

الدكتور عبدالله يوسف المطوع  
 وكيل الوزارة لشؤون التعليم والمناهج

مستشار  
 في مكتب مساعدة الوزير